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The Magazine of

OCTOBER 1951

# TOOLING and PRODUCTION

TOOL & DIE JOURNAL

HARDINGE
ELMIRA, N.Y.

## Style "S" Master Collets

ow Cost Pads

**FOR QUALITY PERFORMANCE**

Only HARDINGE Master Collets and Pads have this independent double dovetail clamp which anchors the pad in place . . . . . no threaded holes in Master Collets or Pads.

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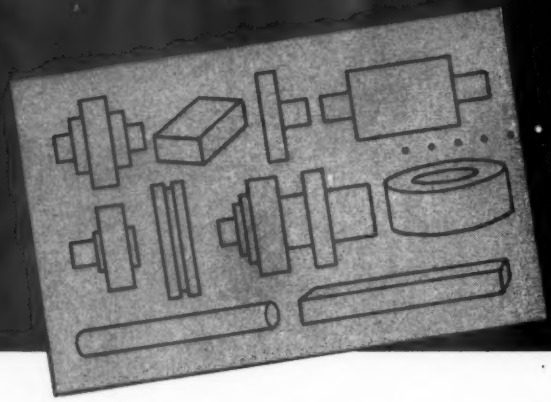

# Stainless Steel Forgings

## *to Your Specifications*

**Rough Machining**
**Heat Treating**

We can supply clean, top-quality stainless forgings either "as is," or rough machined, heat treated, etc.

Any Allegheny Ludlum field representative will gladly give you further particulars, or write us direct.

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**RINGS . . . DISCS . . . BLOCKS . . . BARS . . . SHAFTS**
**SPINDLES . . . HUBS . . . SPECIAL SHAPES**

Desired forgings in the available types of stainless and heat-resisting steels are produced in a wide range of shapes and sizes by our Forging and Casting Plant, noted for uniformly consistent properties and finish.

Experienced personnel, complete laboratory control facilities, excellent equipment and substantial capacity combine to assure quality and service.

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You can make it **BETTER** with

# Allegheny Metal

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TIME-TESTED STAINLESS STEEL

W&D 3670 B

**This new Putnam two flute keyway end mill is designed especially to solve your tolerance problems in keyway milling. Each size is available in three compensating limits: for instance, the ½" mill is made in .499", .498" and .497" diameters, each with + .001" — .000" tolerance.**

**For full facts on this or any of the 1000 Putnam end mills, write for Catalog No. 52 on your letterhead.**

**PUTNAM**
TOOL COMPANY
2981 CHARLEVOIX AVENUE · DETROIT 7, MICHIGAN

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The Magazine of

# TOOLING and PRODUCTION

TOOL & DIE JOURNAL

1975 Lee Road • CLEVELAND 18, OHIO
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**EX-CELL-O CORPORATION**
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RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT
AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

51-53


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• BAKER-RAULANG COMPANY, says:

# a Cincinnati Shear brought these results

| | |
|---|---|
| 1 | lower costs |
| 2 | stable deliveries |
| 3 | steady stock supply |
| 4 | flexible manufacturing |

Photos courtesy Baker-Raulang Company, Cleveland, Ohio

With the installation of this Cincinnati Shear, a do-it-yourself program replaced dependence on outside sources at the Baker-Raulang Company, manufacturers of industrial trucks.

Sheets of any required size are now sheared without delay and are always ready for assembly when needed. This results in a smoother, controlled manufacturing schedule, reduced inventory and, at the same time, improved deliveries.

The accurate performance of Cincinnati Shears reduces shearing costs —savings in subsequent fabricating operations result from better fits.

If you use sheared sheets, a Cincinnati Shear in your own shop may save you money.

Write for Catalog S-5—covering the very complete line of Cincinnati All-Steel Shears.

THE CINCINNATI SHAPER CO.
CINCINNATI 25, OHIO U.S.A.
SHAPERS SHEARS BRAKES

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In order to provide proper spring tension and a hard bearing area only selected bar stock is used. In addition, the bearing sections are accurately hardened, assuring long lasting, trouble-free operation. Thread tolerances are carefully checked to insure snug fit in the feed tube.

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*Always Better Constructed*

*Accurate Benco Collets, Pushers and Pads*


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The REGINA
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Portelvator, stationary installation, automatic, self-leveling, for sheet feeding operation.

Portelvator, twenty-five ton capacity, roller top, self-loading and self-discharging, for die transfer.

# SAFE AND ACCURATE LIFTING—LEVELING

Hamilton Industrial Elevating Tables, which embody the safe and accurate Portelvator© lift principle, have attained wide use in die transfer, stock positioning, elevating, and leveling. Built to meet each users requirements, they may be manually or electrically operated; controls may be hand or foot operated, or completely automatic; capacity, lift, and installation details may be varied at will. Characteristics such as roller-conveyor tops, tilt tops, and the like, may also be incorporated.

If your job involves lifting, leveling, or transporting, of out-size or unusual nature, our experience in solving just such problems is at your disposal. **Write for Bulletin P-501.**

SAFETY of OPERATION is inherent in the PORTELVATOR© mechanical lift principle, which transmits power through worm, worm gear, and screw.

Portelvator, portable elevating table for movement of automobile body dies.

Portelvator, built for basement installation to supply extra high lift at ground level.

THE Hamilton TOOL COMPANY

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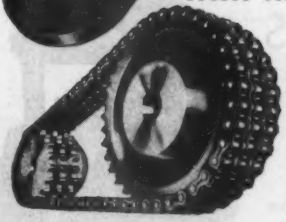
# PRODUCTO DIE SET

## AIDS WHITNEY CHAIN COMPANY...

## WITH HEAVY DUTY PRODUCTION JOB!



The progressive 4 pin Producto Die Set shown provides the accuracy and ruggedness required to emboss, pierce and blank Pin Link Plates for Whitney Roller Chain Drives . . . 3 at a time . . . on a Niagara press.

**OPERATIONS**

Station No. 1 — Whitney Chain markings are clearly embossed for each link.

Station No. 2 — Four holes, two to a link, are rough pierced.

Station No. 3 — Two chain links are blanked out on each press stroke.

**TOLERANCES**

Hole diameter + .0005" — .0005"
Hole centers + .001" — .001"
Link Contour + .005" — .010"

**PRODUCTION RATE**

153,000 links blanked per 40 hour week.
Between grinds, 75,000 pieces.

**MATERIAL**

¼" thick SAE 3140 hot rolled steel in coiled stock.

Buy Producto Special and Catalog Die Sets . . . play safe when performing heavy duty stamping operations.

Call Producto in your classified telephone directory. Representatives in 36 main stamping centers.

If you haven't already received our new #10 Producto Die Set Catalog, write today for your copy.

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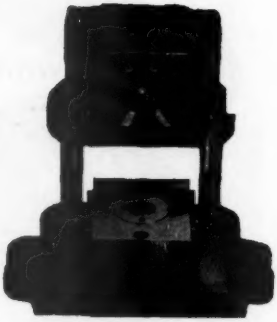
"A MUST wherever WASHERS are made!"

# HOVIS

## OFFERS YOU THIS SIMPLE, UP-TO-THE-MINUTE METHOD

**There's no need to make a complete new Die for any type washer or blank. The HOVIS UNIVERSAL WASHER DIES provide a Master Holder and by merely changing 5 SMALL, EASILY REMOVABLE PARTS the new washer or blank is produced . . . Special sets of parts are available for use in Master Washer Units enabling customers to produce irregularly shaped pieces and shallow draws. Multi-Washer Dies are also designed and manufactured.**



**Made in 5 sizes:**
**¾"—1½"—2½"—4"—6".**

***Write for literature.***

**HOVIS SCREWLOCK COMPANY**

**8100 E. NINE MILE ROAD** **VAN DYKE, MICHIGAN**
**Phone: Slocum 7-1334** **Suburb of Detroit**

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# Versatile BLISS Hydraulic allows unusual metal design

A new 600-ton Bliss double-action hydraulic press enables Carrier Corporation to produce the smooth-looking, but hard-to-make contours for its extensive line of air conditioners.

"By varying ram, blankholder, and cushion pressures and the draw cycle, we have been able to complete difficult drawing operations with sharp corners and small radii at the bottom. The press' flexibility also enabled us to use, more successfully than ever before, steel sheets which remained in stock for a long period, some showing evidence of open grain structure. Actually the press has exceeded our expectations," reports George R. Auld, Carrier's Vice President of Manufacturing.

The press has been operated continuously on a 24-hour basis at maximum speed—*without missing a stroke.* No adjustment or maintenance attention was necessary. "At no time has the press ever been down due to its own inability to operate," says Mr. Auld.

This is another "live" example of what Bliss engineers mean when they promise "the right press for a given job." It's your guarantee of equipment precisely suited to your requirements, whether it's a single press—mechanical or hydraulic—or a complete stamping plant.

**E. W. BLISS COMPANY, CANTON, OHIO**

*Mechanical and Hydraulic Presses, Rolling Mills, Container Machinery*

*1,200 14-gauge drip pans are drawn and formed daily in this Bliss press which has 200 tons blankholder pressure and 400 tons plunger capacity.*

*Hard-to-make contours in this center section stamping for a Featherweight are drawn from 20-gauge steel at a rate of 1200 daily.*

*Top panel for window model Room Air Conditioner has intricate contours, sharp corners and bottom radii. Produced at rate of 1,200 per eight-hour shift from .018-gauge steel.*

From a single press for a given job...to a complete press room... It's Bliss

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# So this is "Diaforming"

**Simple — isn't it? — this modern, fast method of forming and re-forming contours of grinding wheels by hand-following the contours of inexpensive templates with a tracer point. DIAFORM is a fast, accurate, portable Attachment. Just mount it on chuck of your Toolroom Surface Grinder, and it's all set to do a precision job whenever you need it — *to an accuracy of .0005" in a matter of minutes.* Write for detailed information.**

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A U. S. Slide Feed, Plain Straightener and Centralizing Type Stock Reel convert a conventional inclined press into an automatic machine.

## U. S. Equipment Can Give You Higher Efficiency in Your Press Room

# Cut Labor Costs— Improve Output

The Defense Order program, together with the accompanying tightness in the skilled labor market and scarcity of materials, accentuates the importance of using automatic operations wherever possible.

For operations in the press room, the U. S. Tool line is designed primarily to save labor and material costs. This line of equipment includes: U. S. Slide Feeds, Roll Feeds, Stock Straighteners, Stock Reels, Coil Cradles, Scrap Choppers, Stock Oilers and Wipers.

A conventional press, when equipped with a U. S. Slide Feed, Straightener and Stock Reel, is converted into an automatic machine. (See photo at top left). U. S. Slide Feeds are recognized as the most accurate on the market for feeding coil stock automatically into punch presses. Their accuracy results in material savings, increased production, lower die costs and reduced maintenance.

The illustrations show a few of the units in the line of U. S. Automatic Press Room Equipment. Complete specifications are contained in Bulletin 80-T. Write for your copy.

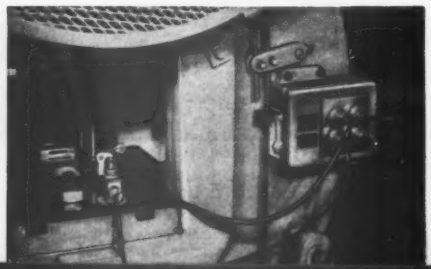
U. S. Power Driven Straightener, pedestal type, with variable speed drive and mercury switch control. Made in a range of sizes. Unit shown accommodates material up to 12" wide x ¼" thick.

# U. S. TOOL COMPANY, Inc.

Below, Left: U. S. Scrap Chopper shown used with a conventional press. Scrap Chopper is individually motor driven, and can be moved wherever desired. Right: U. S. Multi-Stop mounted on press. Can be set up with up to four micro-switches to stop press if stock buckles, if end of coil is reached, etc.

255 North 18th Street
Ampere (East Orange) N. J.

**Builders of U. S. Multi-Slides—U. S. Multi-Millers**
**U. S. Automatic Press Room Equipment**
**U. S. Die Sets and Accessories**



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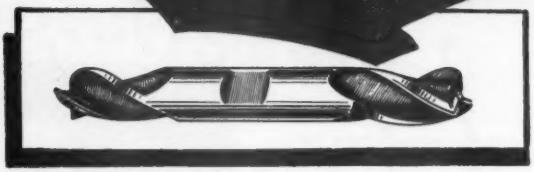
END MILLS . . .

Including THE POPULAR 3 FLUTE!



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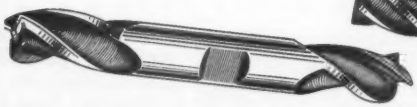
Arrow's "FASCUT" line of End Mills is complete and it is dependable. Backed by 35 years of manufacturing skill and engineering experience, "FASCUT" End Mills assures users high production efficiency.



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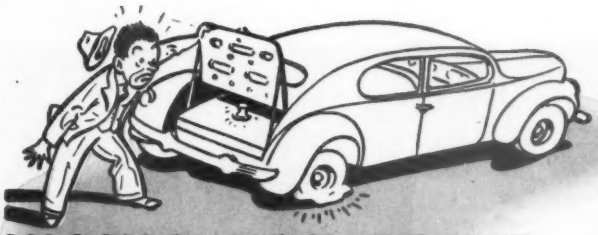

# WOULD YOU DRIVE WITHOUT A *Spare?*

***"Just my luck! A flat tire and no spare! What a predicament!"***

A machine shop foreman may be in a worse predicament without a spare arbor. When an arbor breaks, production ceases until the arbor is replaced. Machine and manpower hours wasted! Schedules disrupted! Deliveries delayed! That's why we say —

***It Pays to Have Several Arbors in Stock***

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THE KEMPSMITH MACHINE CO., 1829 S. 71st St., Milwaukee 14, Wis.

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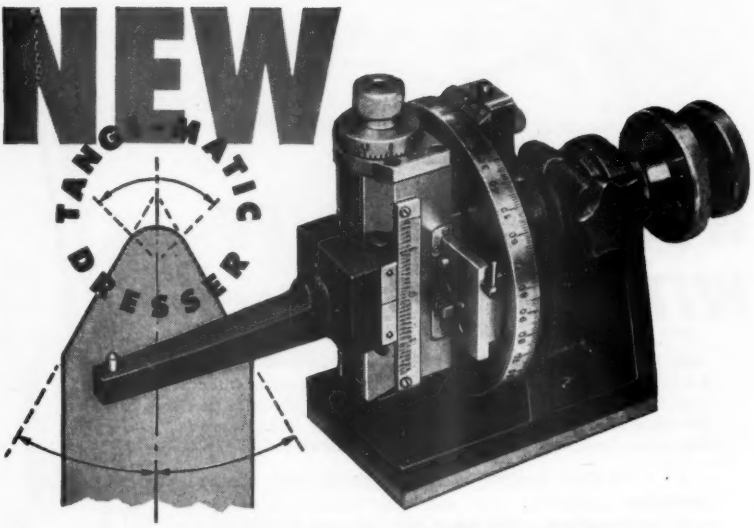


## can save you HOURS daily

Now you can set up for dressing *any* grinding wheel form in *one-fourth the time*—and with precision to "tenths!" Our new TANGI-MATIC has a direct-reading micrometer *built in*—no "mikes," no height gage, no Jo Blocks—no errors. To dress any angle tangent to radius, you turn the micrometer dial and the vernier scale to "zero," adjust the diamond to the Master Gauge we furnish, then lock diamond with set screw. To obtain any radius down to .032", full 180°, you operate as a "mike," the feature which made our RADI-MATIC Radius Dresser famous.

The Perfex TANGI-MATIC is made by master gagemakers who specialize in gages and other precision instruments. All wearing parts are of steel, hardened, ground and lapped for a long life of precision service. The lead screw is hardened and ground to extremely close tolerances. Carrying case furnished for TANGI-MATIC and Master Setting Gage. Write for literature. And for all thread, plug and ring gage requirements, remember the Perfex reputation.

**PERFEX GAGE & TOOL COMPANY**

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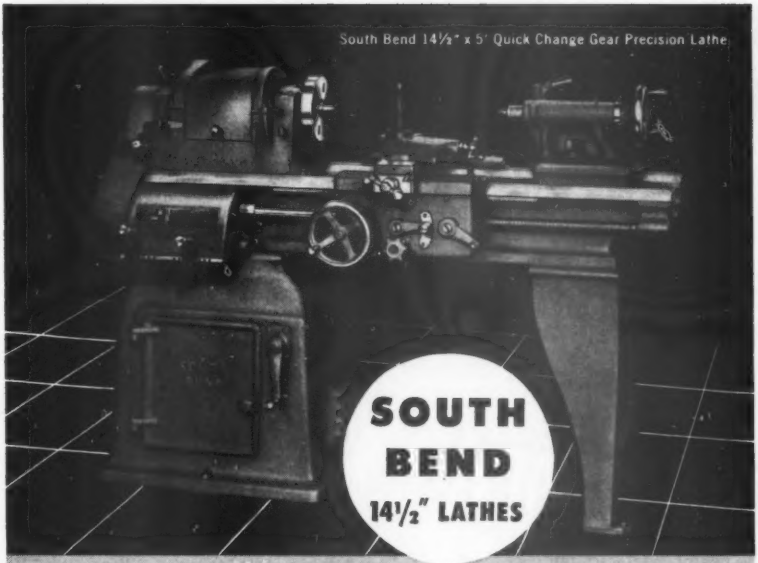


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**SPECIFICATIONS**

Swing over bed and saddle . . . . 14-5/8"
Distance between centers 24½ to 60½"
Maximum Collet Capacity . . . . . 1"
Spindle Speeds . . . 8—27 to 800 r.p.m.
Power Longitudinal Feeds, 48 R. H. or L. H. . . . . .0015 to .0841"
Power Cross Feeds . . 48, .0006 to .0312"
Thread Cutting, 48 R. H. or L. H. pitches . . . . . 4 to 224 per inch

South Bend 14½" Lathes offer many advantages for precision machining. Ease of operation, speed, power, accuracy, and efficiency are some of the features responsible for their popularity. Often the precision and quality of finish obtained with South Bend Lathes are such that subsequent grinding, honing, or lapping operations are unnecessary. Substantial savings in capital investment, power consumption, floor space, and labor costs have resulted from their installation.

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☐ _____

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☐ 10" to 16-36" FLOOR LATHES

☐ 1½" and 1" Collet TURRET LATHES

☐ 14" DRILL PRESSES

☐ 7" BENCH SHAPERS

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Street _____ City & State _____

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(Actual page size 8½" x 11")

You need this comprehensive and informative new catalog. Makes it easy to select what you need — both visually (from actual-size illustrations) and by printed specifications and with corresponding key numbers. Contains:

***228 individual Nicholson Rotaries*** embracing all popular shapes and head sizes in Hand Cut Hi-Speed Steel, Ground Burs Hi-Speed Steel, Ground Burs Carbide; in both ¼" and ⅛" shank sizes.

***8 kit assortments in 10 to 18 shapes.***

***4 illuminating pages on choosing and using Rotaries.***

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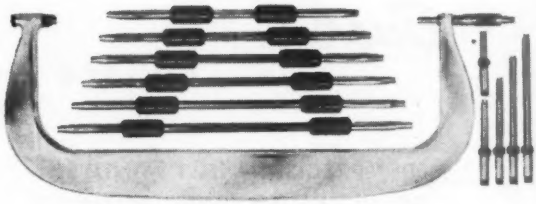
# The TUMICO *Bar Micrometer*



**SHALLOW, TUBULAR FRAME FOR PRECISION LONG-SPAN MEASUREMENT!**

The shallow frame of the Tumico Bar Micrometer slips in where frame clearance is too small for ordinary micrometers. The hollow steel frame cuts weight in half . . . makes precision measurements easy, even in the largest sizes. It is made in over 30 models ranging from 6" to 168". The Tumico Bar Micrometer can be furnished with either adjustable mandrels or sliding bar anvil.

All Tumico micrometers, gages and measuring instruments are fully and easily adjustable for wear. Skilled engineering has reduced weights up to 50%. "Feather touch" feel and balance speeds measurements and assures accuracy.

Tumico instruments control production for many of America's largest manufacturers. Consult us for special production gages, calipers, alignment instruments, etc. Catalog sent free on request.

**TUBULAR MICROMETER CO.**

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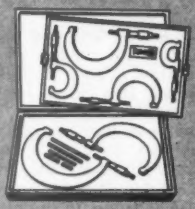
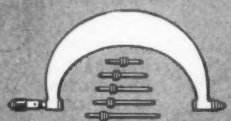
**PRECISION MEASURING INSTRUMENTS**

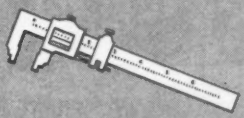
**TUMICO POST GAGES**
Precision micrometer or dial indicator instruments adaptable to a wide variety of uses. 10 models.



**TUMICO MICROMETER SETS**
Complete sets for a broad range of accurate measurement operations. From 0" to 30" in 1" steps.



**TUMICO OVER-THE-BAR MICROMETERS**
Precision bore measurement without removing boring bar. 11 models from 3" to 28".

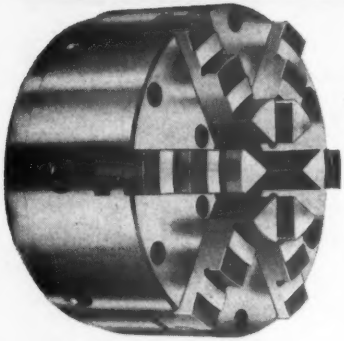


**TUMICO VERNIER CALIPERS**
Precision made. Accurate, clearly etched graduations and numerals. 24 models from 6" to 48".

**TUMICO BAR MICROMETERS**
Provide a wide range of precision measurement with low investment. 30 models from 6" to 168".

SEE ADVERTISERS INDEX, PAGE 183, FOR KEY NUMBERS

# World's Fastest Precision Chuck Speeds Set-Ups, Boosts Production!



**Buck AJUST-TRU CHUCKS**

## .0005" PRECISION IN 1 MINUTE! RECHUCKS TO .0005" WITH SCROLL CHUCK SPEED!

## Nothing Like It!

This is the first **and only** successful dual control chuck. Its operation is easy to understand and use. One pinion (see center of chuck body above) moves jaws in or out to grip work—just like any scroll chuck. 4 opposed screws (only two can be seen in photo) work on the chuck adapter to bring work to dead center. Even dubs have centered work within .0005" in 3 minutes. Once set dead true, hundreds of duplicate parts can be machined without changing adjustment.

Breaking bottlenecks on precision work is made-to-order for a Buck Ajust-Tru!

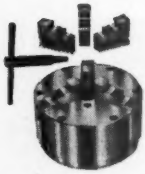
Completely outclasses 4-jaws on set-up speed and rechucking speed! Lines up dead true in **one minute or less**—maintains .0005" accuracy when rechucking duplicate parts **with no further adjustment.**

Many other outstanding features. A 6" 6-jaw Buck **handles the work of 93 collets**—yet is priced in line with ordinary chucks!

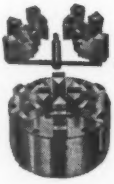
This is just **part** of the complete Buck story. Send for literature and full details.

## BUCK TOOL COMPANY

**1018 Schippers Lane** **Kalamazoo, Mich.**



**3 STEP-JAW CHUCK**
4 sizes—
4"—light duty
5", 6", 7½"
—heavy duty



**6 STEP-JAW COLLET CHUCK**
4 sizes—
4"—light duty
5", 6", 7½"
—heavy duty

**6 JAW PRODUCTION COLLET CHUCK**
4 sizes—
4"—light duty
5", 6", 7½"
—heavy duty

PLEASE USE INFORM-A-GRAM FOR PRODUCT INFORMATION

# Why UNBRAKO "STANDARDS"

**"Standards" keep you in the BLACK**

Standard design and purchase | Standard tools | Standard (fast) production with "standards" from stock | Standard (or higher) profits

**"Specials" put you in the RED**

Special design | Special drawings | Special purchase | Special (delayed) delivery | Special stock

Special tools | Special production | Special bookkeeping | Special costs (higher) | Special profits (lower)

Knurled Head Socket Cap Screws · Flat Head Socket Cap Screws · Self-Locking Socket Set Screws

UNBRAKO

Knurled Head Shoulder Screws · Precision-Ground Dowel Pins · Fully-Formed Pressure Plugs

*STANDARD recommends "Standards"*

SPS STANDARD PRESSED STEEL CO.


SEE ADVERTISERS INDEX, PAGE 183, FOR KEY NUMBERS

# LEVIN® TOOLS ARE DESIGNED
## TO MAKE DELICATE PRECISION EASIER

### MICRO-DRILL PRESS

The Levin Micro-Drill Press is designed to hold small drills in precision collets, thus overcoming the difficulty of getting a drill to run true as when held in a conventional drill chuck. The absence of a sliding quill guarantees maximum sensitivity with fingertip control. A mounted ⅛" capacity drill chuck can also be used. WRITE FOR BULLETIN H DESCRIBING THE MICRO-DRILL PRESS and listing collet sizes.

*for drilling holes as small as .002"*

*Precision jewelers lathes for fine instrument work and second operations*

SEND FOR CATALOG E DESCRIBING LATHES AND ACCESSORIES

COMPLETE CATALOG illustrates and describes full line of accessories: Compound Slide Rests, Grinding, Milling and Screw Cutting Attachments, Cross Slide, Collet Closer and other useful items.

LOUIS LEVIN & SON INC., 782 E. PICO BLVD., LOS ANGELES

# Graph-Mo steel punches and dies cut both metal and wear

THE Wales Sheet Metal Fabricator above features "Quick Change" punches and dies made of Graph-Mo—a Timken® graphitic tool steel.

Several water and oil hardening tool steels were tested. Wales-Strippit engineers report that Graph-Mo was selected because "Graph-Mo punches provide long life with a minimum of galling—guides provide exceptional wear resistance".

Timken graphitic steels contain free graphite, along with diamond-hard carbides formed during heat treatment. This structure gives excellent resistance to wear and abrasion and faster, easier machining than other tool steels. Other advantages are superior non-seizing qualities, good stability, less tendency to scuff and score, and uniform response to heat treatment.

For information on the four Timken graphitic tool steels and their use in punches, dies, gages and machine parts, get the new 10th edition of "Timken Graphitic Steel Data Book". Write on your business letterhead to The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

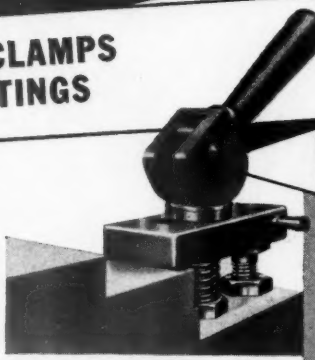
TIMKEN
TRADE-MARK REG. U.S. PAT. OFF.
Fine Alloy
STEEL
and Seamless Tubes

SEE ADVERTISERS INDEX, PAGE 183, FOR KEY NUMBERS

# *OVER FORTY YEARS OF FINE TOOLS*

# SIEWEK

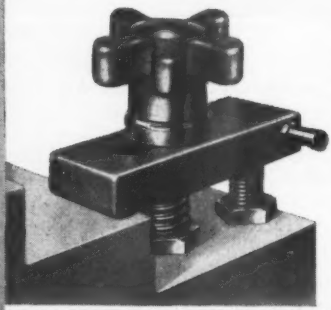
## FIXTURE CLAMPS AND FITTINGS



**STANDARDIZE and ECONOMIZE**

**"SIEWEK" is the originator of standard clamps and details.**

| | |
|---|---|
| Drill Jigs | 161 Sizes |
| Fixture Clamps | 73 Sizes |
| Fixture Details | 156 Sizes |
| Fixture Locks | 12 Sizes |



**JACK LOCKS, FIXTURE LOCKS, CAMS, KNOBS, REST BUTTONS**

Clamp assemblies and other parts necessary for the construction of special fixtures make up this standard Siewek line.

These Clamp assemblies themselves are made in 36 different types, most of them in three sizes. In other words, there is a type and size to meet the requirements of practically all shops.

*Write for full size template drawings for use in layout work.*

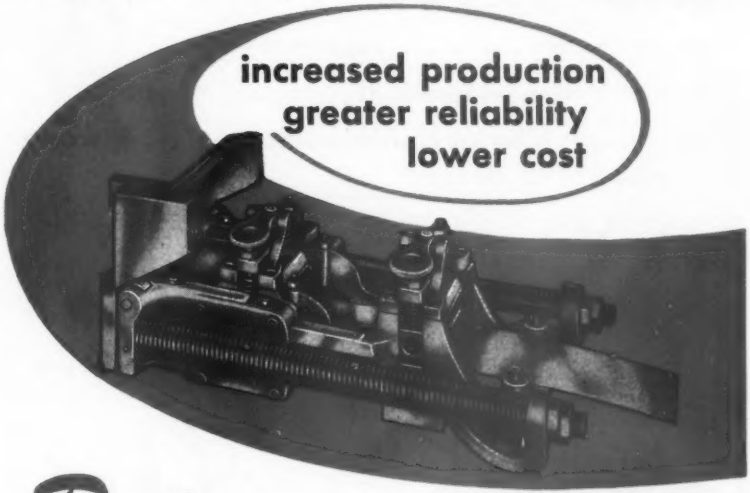
ALSO MANUFACTURERS OF SIEWEK RAPID CLAMPING JIGS & DETAILS

**Siewek TOOL COMPANY**

2862 East Grand Boulevard, Detroit, Michigan

BRANCH OFFICE: CHICAGO — Siewek Tool Co., 224 S. Michigan Ave. Wabash 3509, Chicago 4, Illinois

# PUNCH PRESS OWNERS REPORT




## *Dickerman* 3 in. DIE FEED

**The amazing simplicity and steady reliability of the 3" Die Feed have made it a favorite with punch press owners everywhere.**

**Easy to install, it has no complicated parts to get out of order, adjustments are few and simple and top quality material and workmanship assure millions of cycles without expense.**

**Can be mounted on die set or bolster plate to feed from any direction. Feeds coiled materials such as steel, copper, brass, aluminum, mica, paper, fibre, rubber, plastic. Will not mar smoothest surfaces.**

**Reduces human error factors to a minimum. No costly jams. You save labor costs, material costs, die repair costs. Will handle coiled stock of any practical combination of thicknesses up to 3/16" and width to 4" or 6".**

WRITE TODAY FOR COMPLETE DETAILS

**H. E. DICKERMAN MFG. CO.**

DEPT. J 332 ALBANY STREET SPRINGFIELD, MASS.


SEE ADVERTISERS INDEX, PAGE 183, FOR KEY NUMBERS

**Tiny holes? . . . . . Easy!**

**Accurate holes? . . . . . Easy!**

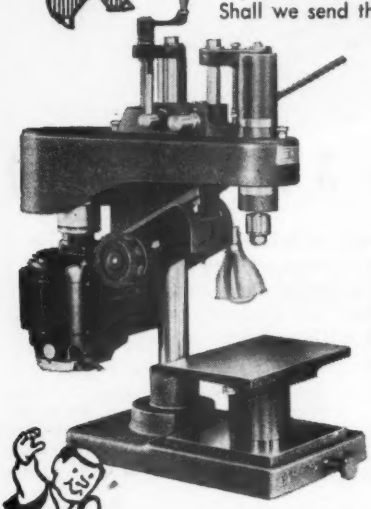
**Holes on production schedules? . . . . . Easy!**

***Tiny, accurate* holes on *production schedules*? . . . WOW!**

Hamilton Drilling Machines can do it!
And withdraw the drill undamaged
from hole after hole after hole!

**LEARN HOW!**

Write for the series of Hamilton Drilling
Machine Bulletins and Price Lists.
(There is also a companion Tapping Machine.
Shall we send that bulletin along with the others?)



Shown here is the Hamilton Varimatic, Super Sensitive, Variable Speed, Small Hole Drilling Machine, one of four models, each particularly adapted to the work for which intended, all equally precise.

THE *Hamilton* TOOL COMPANY

832 SO. NINTH STREET • HAMILTON • OHIO • U • S • A

PLEASE USE INFORM-A-GRAM FOR PRODUCT INFORMATION

**Guarantee**

The Rivett 608 will turn or bore within 0.0001" in six inches work held in collet, and turn between centers within 0.0001" in six inches. The Rivett 608 will face to eight inches diameter within a limit of 0.0002" concave, 0.0000" convex. The Rivett 608 will cut threads within 0.0005" in twelve inches, or within 0.0003" in any three inches, or within 0.0002" in any inch of a specimen piece.

**PLUS every known attachment**

A symbol of extreme accuracy, this Rivett 608 lathe is used in nearly every instrument and tool shop where fine exacting work is performed. A greater number of mechanical marvels have been developed on this lathe than on all other machine tools combined. The 608 is a small but exceedingly powerful back-geared, screw cutting engine lathe, with slide areas equal to those of other lathes twice its size. Finely-made attachments are available for milling, spiral-cutting, slotting, relieving, taper turning, radius turning, grinding, and forming. Write for Bulletin 608F.

RIVETT LATHE & GRINDER, Inc.

Dept. TPR-10 Brighton 35, Boston, Mass.

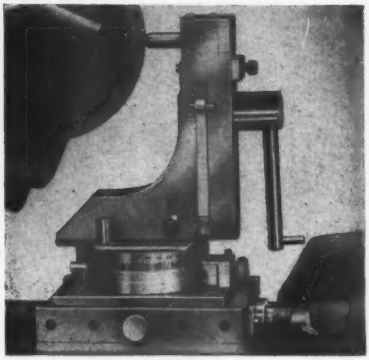
For More Precision Work RELY ON RIVETT LATHES AND GRINDERS, The Master Craftsman's Master Tools


SEE ADVERTISERS INDEX, PAGE 183, FOR KEY NUMBERS

# FASTER FORM-DRESSING

## with J&S *Fluidmotion*

## RADII and ANGLE DRESSERS



Model "C" "Fluidmotion" Dresser

**Dress** Two Angles Tangent to a Radius **in one continuous motion.**

The ONLY Dresser with a MICROMETER FEED.

For use in repetitive precision production, where extremely precise depth of radii and simplicity of operation are required. Lead-screw handle graduated to .001"—moves dresser forward, backward with sensitive **range of full inch.**

"FLUIDMOTION" is the simplest, most accurate method for form-dressing. **It allows dressing** the entire angle-radius-angle wheel profile on surface and cylindrical grinders in **one continuous motion**—with one easy setting. A clean, precise form results, with no tool or chatter marks. Angles and curves flow into each other.

Highly **skilled operators** and elaborate set-ups are **unnecessary. Beginners quickly learn** to turn out contours accurate to .0001".

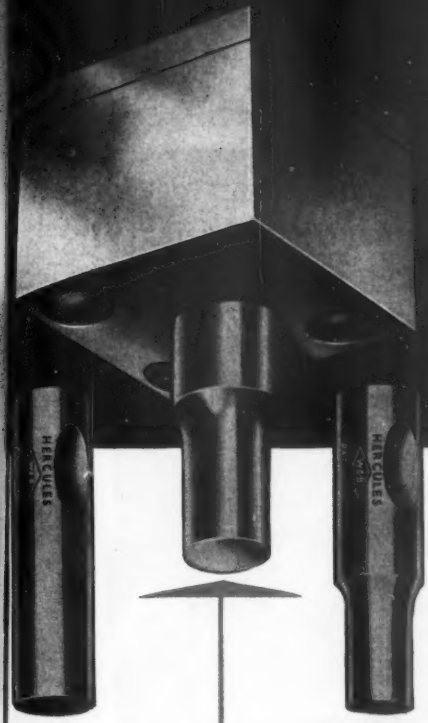
Features: Automatic centering, dustproof and chatterless, high-carbon, high-chrome construction. Dresses wheels up to 20" in diameter—easily adaptable to all surface and cylindrical grinders, with J & S fixtures.

J & S "FORM-MASTER" ANGLE and RADIUS DRESSER—less expensive—dresses both angles and radii.

**WRITE FOR FURTHER INFORMATION**

**SEND FOR BOOKLET, "Machine Shop TIME SAVERS by J & S". Illustrates and explains: Cutting Tools, "Down-Hold" Vise Jaws and "Attachable" Parallels, "All-Purpose" Jaw Clamps, and J & S Form Grinding Service.**

J&S TOOL CO., INC.




# MAXIMUM PRODUCTION

WITH

# W&B HERCULES

## *HIGH SPEED STEEL*

## INTERCHANGEABLE PUNCHES

- WHITMAN & BARNES HERCULES INTERCHANGEABLE HIGH SPEED STEEL PUNCHES ARE IDENTIFIED BY THEIR DISTINCTIVE BRONZE COLOR.

*Some of the Many Advantages:*

- Longer Life.
- Increased Salvage Value.
- Hardness Extends Throughout.
- Better Performance on Abrasive or Tough Materials.
- Can Be Reground to Smaller Diameters or Special Shapes.

**AVAILABLE FROM STOCK AT STANDARD PRICES**

These punches are available with round piercing points, and in blank styles.

Specifications and prices will be furnished upon request.

W&B

*"Makers of Fine Tools Since 1848"*

# WHITMAN & BARNES

PLYMOUTH, MICHIGAN

NEW YORK • CHICAGO • LOS ANGELES • HOUSTON

# NEW SOUND MOVIE

## tells an eye-opening true story of cost-slashing production efficiency!

## WATCH MULTIPRESS® IN ACTION in a space-saving production line that ends lost motion, cuts noise level, speeds output, and makes the operators' jobs easier!

Here's your chance to see how one of the biggest makers of auto-door latches and similar parts has blown the lid off all previous production records.

You can see how 13 fast-working Denison Multipress units form a complete, highly efficient assembly line in less than 500 square feet of space.

Parts move between stages by the shortest possible routes, on chutes and conveyors. Fast, easy, safe parts-loading is assured by HydrOILic Index Tables on 11 of the presses.

You can follow the oil-smooth, controlled accuracy of Multipress in action. You can see why its compactness, versatility and easy operation pay off so well in high production, quality control, lower scrap losses and increased safety.

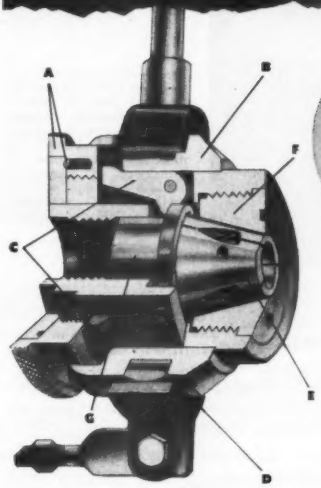
Show this lively film, at your next meeting, convention, or school program—or at any get-together of shop employees, foremen, or production heads. It's a 16 mm sound-track film cut to 16-minute running time. We'll gladly let you use the film without obligation. If you don't have projection equipment, a Denison representative can handle the entire showing. Write for details.

DENISON HydrOILics

**The Denison Engineering Co.**

1197 Dublin Road Columbus 16, Ohio

# Get a better Grip on PRODUCTION




with the **Levermatic COLLET CHUCK**

One customer solved a serious holding problem on a 4-station hobbing machine by using Levermatics. Formerly the carbide-tipped centers holding the work were breaking much too frequently — though the shaft being cut was supported by a follower-rest. Levermatics now grip the work positively, assuring greater accuracy and uninterrupted production. Another Levermatic operator cut machine rates from 44½c to 22½c per 100 pieces.

We can tell you of many shops with hundreds of special adaptations to engine lathes, turret lathes, grinders, milling machines, drill presses, etc. Send the coupon below!

**CONSTRUCTION FEATURES**

- **A — Pressure adjusting ring with ball detent lock**
- **B — Positive cam closing collar**
- **C — Hardened cam levers (three)**
- **D — Self-lubricating bronze yoke shoe**
- **E — Parallel grip design collet**
- **F — Precision ground closing ring**
- **G — Collet pusher sleeve**

Instant adjustment of ring for any collet pressure

**SUTTON TOOL COMPANY**
**STURGIS, MICHIGAN**

*GET THIS BOOK FREE*

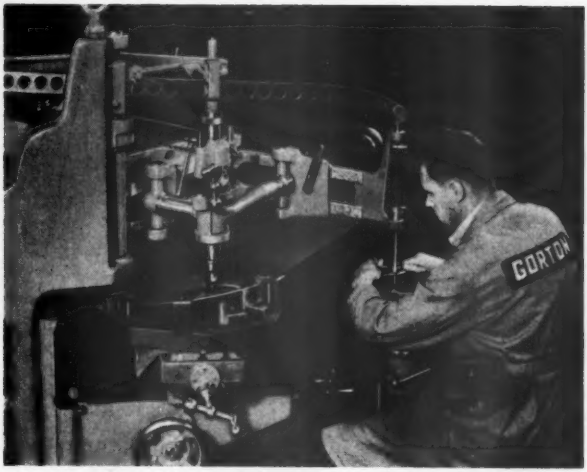
**SUTTON TOOL COMPANY**
**100 Magnolia Street, Sturgis, Michigan**
**Send new Levermatic 8-page catalog free.**

Name_____

Company_____

Address_____


SEE ADVERTISERS INDEX, PAGE 183, FOR KEY NUMBERS




Tracer-Controlled Pantograph cuts and rounds thermal slot in 8-foot steel propeller blade in 40 minutes; previous time was 5 hours, 10 minutes — just one of hundreds of examples of time and cost saving with tracer-controlled Pantograph machines.

# Special Machine Tools Speed Production During Rearmament

by
GEORGE GORTON III
Executive Vice-President,
George Gorton Machine Co.

INDUSTRY'S foremost responsibility right now is to produce faster, to highest quality standards and at lower cost — whether on defense contracts or for our civilian needs.

Today, there are literally thousands of operations being performed throughout industry which can be speeded up, improved in quality and lowered in cost by the use of available models of special machine tools. The modern tracer-controlled Pantograph machine is such a tool. It is both a special purpose machine, ideal for short runs, and it is an accurate single purpose machine which turns out identical parts or pieces to meet tight production schedules.

The tracer-controlled Pantograph machine is used for inside and outside profiling, routing, die sinking, mold cutting, counterboring, contour milling, chamfering, grooving, graduating and engraving in ferrous and non-ferrous metals, as well as in plastics.

This machine performs on flat, uniformly curved, cylindrical, spherical or irregular shapes — it works in either 2 or 3 dimensions, in all directions on a horizontal plane, and vertically. It employs enlarged masters, templates or patterns which are quickly and easily made and operates normally at a reduction ratio thereby increasing accuracy — exclusively characteristic of the pantograph.

Single or repetitive accuracy — from one piece to thousands — manual or full automatic operation depending upon quantities — work sizes from the size of a dime to as large as 10 feet.

A new booklet, "Pantography," explains the process and shows what this type of machine can do for you. It is yours without obligation. Write for it today. If interested, also ask for our latest General Catalog 1655. Address the George Gorton Machine Co., 1210 Racine St., Racine, Wisconsin, U. S. A.

# *Standardize* on PRATT & WHITNEY REAMERS

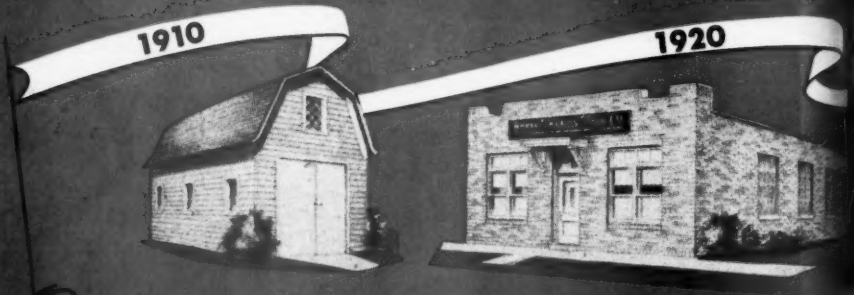
—they have the UNIFORM QUALITY, PRECISION AND LONG LIFE required to meet Today's Critical Needs

1 Stub Screw Machine Reamers
2 Shell Reamers with Spiral Flutes
3 Jig Borer Precision End Cutting Reamers
4 Hand Reamers with Spiral Flutes
5 Blue Helix Fluted Chucking Reamers
6 Carbide Tipped Fluted Chucking Reamers
7 Expansion Hand Reamers with Spiral Flutes
8 Helical Taper Pin Reamers
9 Camlock Adjustable Chucking Reamers with Serrated Blades

"THERE'S NO BETTER-PAYING INVESTMENT THAN THE RIGHT TOOLS FOR THE JOB"

**PRATT & WHITNEY**
Division NILES-BEMENT-POND COMPANY
WEST HARTFORD 1, CONNECTICUT, U.S.A.
*Dedicated to Accuracy for 91 years*

LITERATURE AND INFORMATION MAY BE OBTAINED AT ALL P&W BRANCH OFFICES




# Our First Forty Years.

We are celebrating our Fortieth Anniversary this year with some pride of accomplishment and with a good deal of gratitude to the people who have made this possible.

These include our thousands of friends throughout North America and beyond who have bought our diamonds and diamond products; our many suppliers whose cooperation is so essential, and our company "family" of workers in our several plants and field offices who make, distribute, and service our products.

We have seen this family grow from our original group of three beginners to an organization of nearly two hundred including many outstanding specialists. And, with them, we have graduated through the years from an unheated garage (with practically no equipment) to the most modern of plants and the finest of equipment, much of it exclusive.

Together, we have seen the diamond tool changed from a primitive, handy-man product to a thoroughly scientific tool "engineered to the job" in accordance with the principle which we pioneered forty years ago and developed into recognition throughout industry. Our most recent important achievement has been the development of diamond drill bits for drilling oil wells—the first to prove successful.

To all of these friends—customers, suppliers, co-workers—our sincere thanks.

WHEEL TRUEING TOOL COMPANY

Harry D. Keeze

*President*

ROBERT S. FOWLER
First Vice President

HAROLD E. ROBISON
Treasurer

JAMES H. DILLOW
Secretary

DONALD J. WALLACE
Vice President

HARRY W. WALLACE
Vice President

W. W. WEIMAR, JR.
Vice President
New Jersey

HAROLD B. ZIEGLER
Vice President
New Jersey

TRUING BLADE TYPE DIAMOND TOOLS (Patented)

RADIUS FORMING DIAMOND TOOLS

UNMOUNTED INDUSTRIAL DIAMONDS

STANDARD and SPECIAL DIAMOND TOOLS OF ALL KINDS

## DIAMOND PRODUCTS AND SERVICES

- Diamond Bits for Oil Field Drilling
- Diamond Drill Bits for Mining
- Diamond Reaming Shells
- Prompt Bit Resetting Service
- Complete Stock of Industrial Diamonds
- Tru-Line Diamond Tools
- Single Point Dressing Tools
- The Diamond-Miser
- Radius Forming Diamond Tools
- Diamond Tools for Thread Dressing
- Polished Diamond Contact Points
- Turning and Boring Tools
- Diamond Impregnated Tools
- Diamond Powder
- Special Diamond Tools

# WHEEL TRUEING TOOL COMPANY

*Established 1910*

3200 West Davison Avenue • Detroit 6, Michigan

WHEEL TRUEING TOOL CO. OF CANADA, LTD.
575 Langlois Avenue
Windsor, Ontario, Canada

WHEEL TRUEING TOOL CO. OF NEW JERSEY
33 West Street
Bloomfield, N. J.

Wheel Trueing Plant in Windsor, Ontario

Wheel Trueing Plant in Bloomfield, N. J.

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**3031 Elm Street, Dallas 1, Texas**

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|---|---|---|
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**General Offices: Pittsburgh, Penna.**

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**MINE SUPPLY, INC.**
**Vanadium, New Mexico**

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TRU-THREAD DIAMOND TOOLS

DIAMOND TOOLS

GIANT DIAMOND BIT for oil well drilling

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Every advancement of importance to be found in any boring mill is obtainable in a Lucas. In many cases Lucas has been years ahead, and some very important developments can be found only in Lucas machines. Fifty-one years of specialization on one product has made Lucas the first name in its field.

- Automatic power positioning
- Integrally cast four way beds with 4 point support
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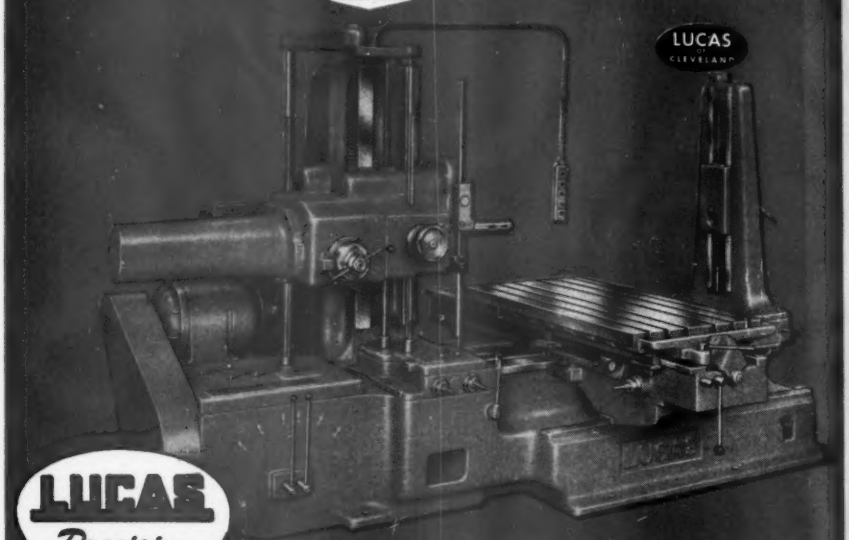



LUCAS *Precision*

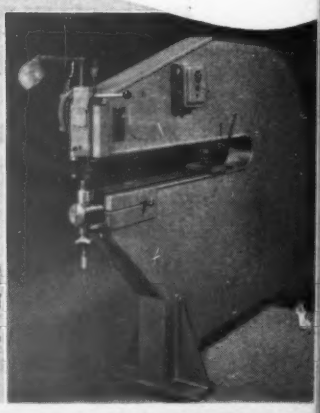
HORIZONTAL BORING, DRILLING AND MILLING MACHINES
LUCAS MACHINE DIVISION, THE NEW BRITAIN MACHINE CO.
CLEVELAND 4, OHIO

WALES SHEET METAL FABRICATOR provides rapid interchangeability for punching and notching. Work from blue prints or operation sheets. *No Templets Required.* Write for Catalog 10-A.

WALES DRILLING MACHINE is specially designed to meet the exacting requirements of locating, drilling and reaming holes in material of practically any length and up to 36" wide. Write for Catalog DM.

WALES TWIN COLUMN PRESS features simplicity of design that fulfills the engineering axiom—"building it simple builds it better". In many cases, this press eliminates the necessity of a die set. Write for Catalog TC.

THE WALES CONTOUR SHEAR cuts and trims irregular shapes and circles and also beads, rigidizes, forms and flanges. Ideal for accurate, short run work eliminating prohibitive die costs. *Send for Catalog TS.*



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# WALES

## SHEET METAL EQUIPMENT

● In practically every sheet metal fabricating plant or department there is a need for Wales Machinery and Equipment. Standardizing on this versatile line assures the exact type for various operations.

*For example,* hole punching and notching operations may be performed on either the Wales Fabricator or on the Wales Twin Column Press with Wales Hole Punching and Notching Units. Depending on the number of parts and the size and shape of the work, one piece of Wales Equipment is more efficient and economical than the other.

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*(Between Buffalo and Niagara Falls)*
**WALES-STRIPPIT OF CANADA LTD., HAMILTON, ONTARIO**

*Specialists in Punching and Notching Equipment*

. . . w[illegible] struggle with
a hea[illegible] die when a
**SHO[illegible]LIFTER**
*"ea[illegible] does it"*
wit[illegible]e man . . . .

No strained backs. No bruised fingers or toes. Complete safety in handling dies up to 500 lbs. with Type D Shoplifter. 1000 lb. and 2000 lb. capacity in Type DX heavy duty models. Also handy for loading trucks and as an adjustable table for handling machine work. Automatic brake holds load at any height.

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*List prices F. O. B. Chicago subject to current discount.*

**Floor lock to hold machine steady**
**$16.00 extra for 500 lb. model**
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## Last *as much as 10%* Longer

Since the inception of this business, we have used only steel containing chromium and/or tungsten • That's why A·B·C Bushings deliver as much as 10% longer service than the average • When a supplier decides to "up" the quality of his steel, it may be a couple of years before his customers get the benefit of the change, their orders in the meantime being filled from stock or blanks antedating the improvement • With A·B·C Bushings, steel of chromium and/or tungsten content is no recent innovation. They've *always* been made from this superior grade steel • That's why it is always good business to specify A·B·C.

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HEADLESS PRESS FIT • SLIP RENEWABLE • FIXED RENEWABLE • HEAD PRESS FIT

Also Headless Liners, Locating Jigs, Lockscrews, Clamps

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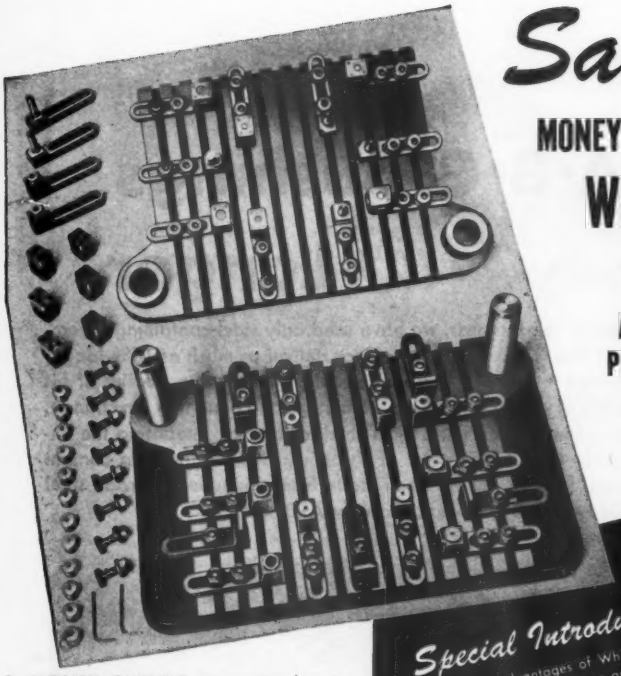

# Save TIME AND MONEY WITH THIS NEW WHISTLER U-375 ADJUSTABLE PERFORATING DIE SET

**A MONEY-SAVING** opportunity to prove in your own plant the many advantages of Whistler Adjustable Dies. Now being employed by thousands of metal working shops. The compact design of this special U-375 unit (10" x 12" working surface) provides up to 25 holes, 1/32" to 3/8" diameter. Pierce materials up to and including 1/16" mild sheet steel...in one operation. Minimum centers of 7/8" are permitted. Set-ups are made quickly and into production within hours. Precision perforating on long or short runs at much reduced expense. Re-use of punches and dies writes off first cost. The U-375 unit is shipped complete ready for immediate set-up.

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To prove the advantages of Whistler Adjustable Dies under your production conditions, we are offering these U-375 units at a special low price.

1 DS-1012-1 (10" x 12") T Slotted Die Set
12 DR-375 Die Retainers
12 PR-375 Punch Retainers
12 PU-375 Round Punches
12 DBU-375 Die Bushings
12 S-375 Strippers
12 LLP-375 Locating Pilots
4 GA-375 Standard Gauges
1 SUP-375 Set-Up Plug

Punches and dies are your own selection of sizes from 1/32" up to 3/8" diameters. Everything needed to start production is included.

Shipped complete upon receipt of your order for only **$280** Net F.O.B. Buffalo, N.Y.

**SENT FREE ON REQUEST**—*Special U-375 Booklet and General Catalogs.* In brief informative style, with clear-cut illustrations, this literature gives complete details about Whistler Adjustable Dies. Write today.

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**748 MILITARY ROAD • BUFFALO 17, NEW YORK**

# Quartz.....Formica....Copper Tubing?

## INGENIOUS Delta SET-UPS CUT THEM ALL

**Faced with problems of machining out-of-the ordinary materials, many shop superintendents and tool engineers have found the solution by adapting low-cost, high-precision Delta wood and metal working machines. Here are typical examples:**

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National Scientific Products Co., Chicago, built a special mounting for Delta 14-inch drill presses, and fitted them with abrasive wheels, to cut wafer-thin quartz crystals for communication instruments. Side-mounted, pivoted drill press heads are actuated by a hydraulic-cylinder power feed. Curtain prevents lubricant splashing

### Cutting Formica

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LeRoi Co., Milwaukee, fitted an adjustable reel to a Delta cut-off machine to cut copper tubing to length. Reel cuts handling time and labor costs, and permits under-bench storage of a variety of sizes

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WOOD OR METAL WORKING
**53 MACHINES — 246 MODELS — MORE THAN 1300 ACCESSORIES**
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MANUFACTURING COMPANY
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# WE GO ALL OUT

*There is a Johnson Dealer Near You*

to Maintain High Machining Standards and Close Tolerances

## JOHNSON METAL CUT-OFF BAND SAWS

**Accuracy in a saw depends entirely on the way it is built. . . . That's why we go the limit in maintaining high machining standards and close tolerances in the manufacture of Johnson Band Saws. YOU CAN'T BUY A BETTER SAW THAN A JOHNSON. For value, capacity, fast, continuous cutting action and economy, Johnson Saws lead the field. They will pay for themselves quickly and give dependable trouble-free service year after year.**

Model J, pictured, 10"x18" Capacity, available as a wet or dry cutting machine. Also Junior Model B, (with or without casters) 5"x10" Capacity.

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Hold Better
Lock Better
Locking is a matter of friction. High uniform accuracy of fit, pitch diameter and perfect thread lead assure maximum thread contact. Twelve and a half inches of thread provide one and one half square inches of contact in a ⅜" x 1" Allen ⬡ Head Set Screw.
The purpose of the point is to hold the shaft against both rotation and longitudinal motion. The Allen screw with the correct point does the job best.

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* Cup point for most applications. Cone, flat, half dog and oval points are standard Allen points available from stock for special requirements.

WARNING
Allen-Type screws aren't necessarily Allen-Made. Get genuine "Pressur-formed" Allen ⬡ Head screws in this black and silver box.

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**MANUFACTURING COMPANY**
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*100% INSPECTION at lowest unit cost*

# SIGMA HIGH SPEED

## MULTI-DIMENSION INSPECTION MACHINES

*Important Features*

- Fully Automatic, Semi-Automatic or Hand Operated
- Check up to 12 dimensions on each piece simultaneously. Sigma has built special machines to check as many as 28 dimensions simultaneously on a turbine blade in 12 seconds.
- Checks External or Internal Dimensions, Depths, Profiles, Concentricity, Tapers, Squareness of Faces
- Easily and quickly set to the required tolerances
- Rapid change of set-up from one part to another
- Handles pieces from ¼" to 4" wide and up to 8" long
- Results are instantly visible by signal lights
- Guaranteed accuracy of Electric Signal Gauge is .00005
- Inspects up to 10,000 pieces per hour
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Sigma Automatic Multi-dimensional Inspection Machine with magazine feed for checking six dimensions on wheel studs. Output: 2,500 per hour.

Send us blue prints or samples of parts you want checked, giving us your inspection requirements. Our Engineers will be glad to make suitable recommendations.

SEE THESE MACHINES IN OPERATION AT COSA'S NEW YORK SHOW ROOM OR SEND FOR DESCRIPTIVE LITERATURE.

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# BE SURE YOU GET THE BEST

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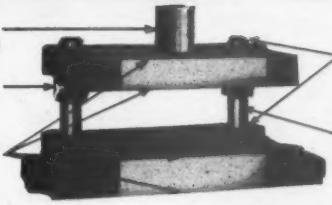
Shanks cast-on, inserted or welded
"Detroit" bushings are full-bearing
Parallel surfaces held to exceptionally close limits
Leader pin holes and bushing holes are micro-metric jig bored
"Detroit" precision leader pins are superfinished

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*For prompt factory delivery, call "Detroit"*

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## DETROIT DIE SET CORPORATION

**2895 W. GRAND BLVD. • DETROIT 2, MICH.**

DETROIT DIE SET ★


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ORIGINAL

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. . . manufactured at the C. E. Johanssen factory in Eskilstuna, Sweden are now available on the American market at prevailing prices.

also JOHANSSON INDICATOR and MIKROKATOR GAGES

AS DEPENDABLE AS JOHANSSON GAGE BLOCKS

For all Internal and External Checking

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A DIVISION OF SWEDISH GAGE CO.

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## REPLACEMENT CUTTER BLADES

Carbide-Tipped • High Speed Steel • Cast Alloy

- Our engineers can help you get more production and reduce tool costs by selecting the blade materials best suited to your requirements in milling and boring work.
- They are qualified by Ingersoll's 60 years of experience designing and building milling and boring machines and the cutting tools that go with them.
- Replacement of cutter blades is an important part of our business — so important that we now build seven replacement blades for each blade furnished originally.

THE INGERSOLL MILLING MACHINE CO., ROCKFORD, ILLINOIS


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STANDARD STEEL BLOCKS
CARBLOX CARBIDE
ANGLE BLOCKS
Prompt Delivery
For years Webber has dedicated itself to the production of gage blocks at a price that even the smallest shop can afford.
Quality and precision have not been compromised in this undertaking. Ask those who use them. Write for literature.
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LARGEST EXCLUSIVE MANUFACTURER OF PRECISION GAGE BLOCKS

MICROBORE
by DeVLIEG

FOR PRECISION WORK
EQUIPPED WITH
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MICROBORE TOOLS

Special Boring Bars

BORING ●
TURNING ●
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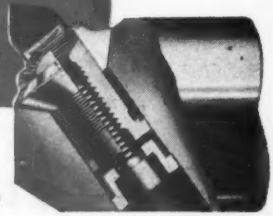
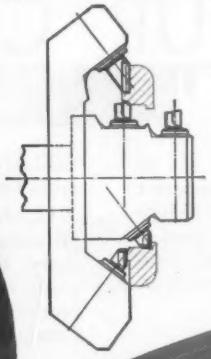
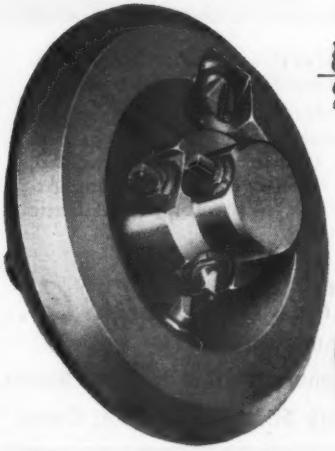


*Each tool independently adjusted by proven micrometer, vernier principle.*

**Illustration shows a special tool used in boring and turning a bearing housing for farm implements.**





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## BAND SAW BLADES

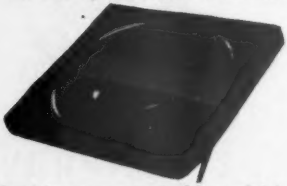
*for Smoother*

## CONTOUR CUTTING

ATLANTIC SAWS meet all of your requirements for a superior blade on complicated die and fixture radius cutting. ATLANTIC specializes in accurate milled and precision set teeth, hardened to exact temper.

ATLANTIC'S special alloy steel insures longer wear and easier welding.

ATLANTIC'S one temper saw for all metals reduces stock you have to carry. Cut to length and welded, ready for use. Packed in strong Atlantic box. Write for new Atlantic Catalog.



Atlantic's strong, practical box, plainly marked on sides and top. Remains in good condition until entire coil is used.

*Atlantic Saw Mfg. Co.*

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Exclusively Manufacturers of Band Saw Blades

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*First quality*

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5% Cr — air hardening
NO. 2
NO. 3
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4% Cr — 1% C
MARVEL
9.50% W — 3.50% Cr
HOTPRESS
9.50% W — 2% Cr
WW HOTWORK
12% W — 12% Cr
FORGE-DIE
2% C — 14% W
SC SPECIAL
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RED CUT SUPERIOR
( I TEMPER )
.50% C — 18% W
VAN-LOM
.90% C — 8.75% Mo

These Die Steels are designed to meet your every hot work requirement. They are made to exacting standards and inspected by magnaflux, reflectoscope and deep etching to insure First Quality Steels. All grades are available in bars and forgings.

Our sales representatives will be glad to work with you in selecting the best grade for your particular job and in the correct heat treatment for maximum performance.

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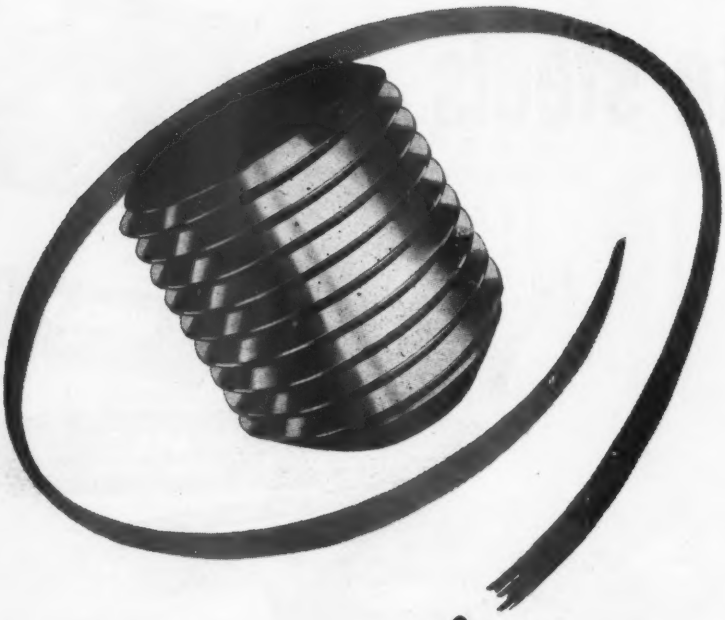
**STEEL COMPANY**
**LATROBE, PENNA.**

COLONIAL STEEL DIVISION · ANCHOR DRAWN STEEL CO.



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**for more of**
**industry's finest products**
**than ever before**

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To make sure of fastenings equal in quality to other components, more manufacturers are specifying Parker-Kalon Socket Screws than ever before. The reasons are clear.

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P-K production is going all-out to meet this mounting demand. For D.O. or other assemblies, set your standards by P-K quality. Parker-Kalon Corporation, 200 Varick St., New York 14, N. Y.

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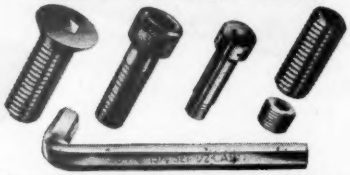
TRADE MARK.
REG. U.S. PAT. OFF.

**FOR ANY TYPE OF SOCKET SCREW**
**REMEMBER — IF IT'S P-K . . . IT'S O.K.***



Flat Head Socket Cap Screws • Size-marked Socket Head Cap Screws
Stripper Bolts • Ground Thread Socket Set Screws • Pipe Plugs • Hex Keys
Available Through Accredited Distributors.

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**PARKER-KALON***
*cold-forged*
**SOCKET SCREWS**

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•Years of successful experience in *special* tooling and related production problems are yours for the asking. When the job requires *special* tools call in your National Tool Co. representative. He is backed by more than 45 years experience in the engineering and manufacture of *special* cutting tools. This engineering service is yours—without obligation.

**NATIONAL TOOL CO.**

CLEVELAND 2, OHIO

REPRESENTATIVES IN MAJOR INDUSTRIAL CENTERS

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KEY SEAT and DOVETAIL CUTTERS by Reltool

Shank and Arbor Types

• Woodruff Key Seat Cutters by Reltool are furnished in both Shank and Arbor Types. Right Hand Cut, shank type, carried in stock; Left Hand Cut, *special*. Arbor Type Keyseat Cutters have staggered teeth, with side teeth relieved for narrow margin.

• Reltool Dovetail Cutters, Shank Type, are designed to take the place of arbor type and threaded hole angle cutters . . . for use in Reltool End Mill Holders.

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Reltool CORPORATION
RELIABLE METAL CUTTING TOOLS

4540 W. BURNHAM ST. • MILWAUKEE 46, WIS.

A 5954-½


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# authors of quality

Now that the last page, paragraph and sentence of this issue have been finished-tooled and put in production, the most important job of all falls upon you, the reader. We have spared no effort that this shall be as pleasant and beneficial a task as you could wish.

This is our 4th Annual QUALITY CONTROL Feature Issue. As proud of it as we may be, the real credit for the meat and substance contained in these pages must go to the several authors whom we have prevailed upon to share their knowledge with you. There is something extra-special for all. You will find many ideas to use and to pass along to your associates.

You don't have to be an automobile manufacturer to have a gaging problem. Are you producing air valve parts at such a high rate that GO-NO-GO gages can't keep up? Ford Motor Company had such a problem and Roscoe Smith tells how they licked it.

Who gets the blame when things go wrong, quality-wise? Or, as Joseph Manuele of Westinghouse has titled his article, "Who is Responsible for Quality?" You'll have to read his story in order to find out whether it is the foreman or the inspector!

Are you all enthused over the money savings represented by Quality Control? We quote: "We were interested in something more than money, we were interested in safeguarding the reputation we had painstakingly built up over the past thirty years." Al Toth's accounting of the Cleveland Graphite Bronze Quality Control program has plenty that you can start using next week.

What do you have in common with The New York Air Brake Company? If you are doing precision grinding to a .0001" tolerance on machines normally capable of holding to .0003" only, you can appreciate what Russ Penney had to go through. As he shows, it can be done, thanks to Quality Control.

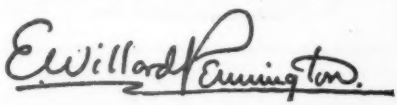
H. S. Gist, Nash Master Mechanic, had to put in a plug for their Statesman model on account of the quietness and durability of the gears in their synchro-mesh transmission. He attributes this to ". . . . a program of Quality Control which has been projected into every operation in the transmission department. . . ." If you've got gear noise, this story will make you gnash your teeth in envy.

Chief Inspector Harrington of the King-Seeley Corporation, long experienced in the workings of Quality Control, serves up warnings as to pitfalls that may be encountered, in addition to stressing the things that are most productive in cutting costs and improving quality.

Maybe you have a headache due to speed; a mechanism that performs according to the dictates of quality at slow speed only. When you speed it up to its intended rate, something goes sour. At that speed you can't see, hear or feel anything wrong. What to do? John Waddell, of Wollensak Optical Company, pours a flood of light on the subject and shoots as many as 14,000 pictures in a second. Projected on the screen, there's your spring contact jumping all over the place instead of making contact!

Our authors are busy men, and in these troublesome times they are busier than ever. It can be taken only as a compliment to the readers of TOOLING and PRODUCTION that these men have been willing to devote "extra-curricular" time and energy to the building of their stories so that you in particular and industry in general may benefit from their experience here recorded.

Next year will see our 5th Annual QUALITY CONTROL Feature Issue. How we're going to be able to make it better than this one is certainly the sixty-four dollar question. All we can say is that it won't be for lack of trying.



editor

# Bearing Down on Quality

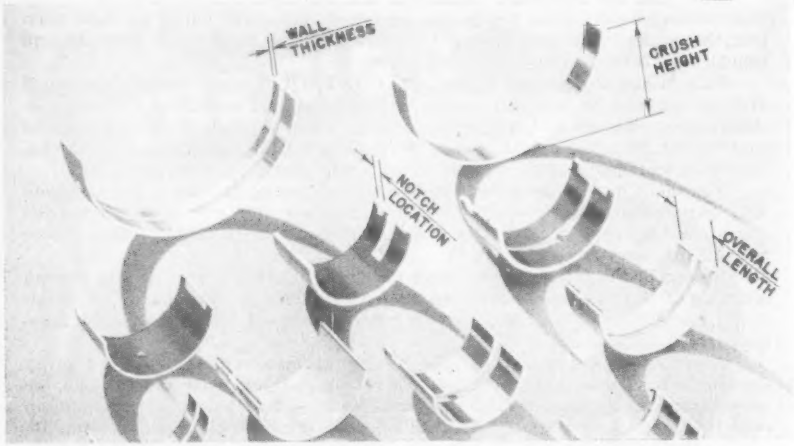



**Fig. 1. This display of bearing components made by The Cleveland Graphite Bronze Company shows critical dimensions which have been subjected to chart control during production. Any appreciable deviation in these dimensions would lead to product failure.**

The Cleveland Graphite Bronze pioneered, designed and introduced most of the sleeve-type bearings and bushings in use today. The fact is that almost every device which employs a revolving shaft can use the precision products we manufacture in our four plants.

### Organizational Setup

The relationship of inspection, manufacturing and engineering in our company is unique in that the inspection department is part of the manufacturing division. This organizational setup was made six years ago, and it has added strength because engineering and manufacturing must work as a team.

This new organizational setup was later to become the firm foundation for the introduction and the propagation of Quality Control by statistical methods.

*by* **A. V. Toth**

*Quality Control Engineer*
*The Cleveland Graphite Bronze Company*
*Cleveland, Ohio*

We had heard of statistical Quality Control prior to 1943, so when the War Production Board sponsored an intensive ten day course at nearby university in 1944, we sent an engineer to take the course and report on the probable applications in our company. He made a few pilot applications on chart control on his return, but working alone he was unable to work up sufficient enthusiasm in the production personnel to overcome the inertia caused by statements, "Our business is different," "Our tolerances are too close for chart control," therefore the original effort was abandoned.

Five years later, early in 1949, our top management having heard of the manifold benefits obtained by the use of chart control, decided to try anew the methods which had been used by such apparent success by others.

### ". . . . . try, try again"

This time, however, everyone recognized that the installation of statistical methods would require a continuous selling job until such time that the procedures would sell themselves to the

production men. Although much of the literature up to this point gave many glowing accounts of money saved through reduced inspection costs, our prime concern was to improve the quality of our products. We do not wish to give the reader the impression that we were not interested in saving money. We were interested in something more than money, we were interested in safeguarding the reputation which we had painstakingly built up over the past thirty years. We were and still are willing to accept all savings which would accrue through the use of statistical methods.

We are guided in our manufacturing processes by blueprints which show the usual maze of dimensions. Our designers expect strict adherence to all dimensions and they look askance when they are approached for deviations. However, they do agree that all dimensions shown on the drawings are not of equal importance, and that deviations are possible and occasionally permissible, even on major dimensions.

A major dimension is one which when deviated from to a great extent would lead to an early failure of the product.

### Tolerances Involved

The tolerance we have to work with vary, depending upon the particular dimension or characteristic involved, Figure 1. For example, the crush height has a tolerance of ± .0005 inches, while the overall length has a tolerance of ± .005 inches. One of the closest tolerances we have to work to is the one on the wall thickness which is ± .00015 inches.

It was on the major dimensions that we felt we should concentrate our efforts of manufacturing chart control. One such major dimension is the crush height of the insert-type engine bearing with a tolerance of ± .0005 inches. The bearings are held in a hardened steel fixture block of the same diameter as the high housing bore, thereby simulating actual assembly conditions. The parting line faces are then machined on a vertical broach. We had deemed this operation so important that an inspector was assigned to work with each machine operator in order that the output of each machine could be inspected immediately.

### Initial Charting

Because of the urgency of reducing the amount of defective pieces which got by our inspection system at this operation, we decided to start our charting at this operation. This was contrary to all accepted starting points because the

*(Continued on page 194)*

Supervisors and foremen were given training in all phases of Quality Control. Attendance at all sessions was required since the course was given on company time.

# Ford Indicates the Way to Quality

The means of measuring has invariably been dictated by the need.

This need significantly asserted itself when man gave up his complete independence in favor of community life. Organized agriculture, organized manufacturing, the preparation of things for sale and other factors of the like, made it necessary for man to resort to more absolute systems of measurement than had heretofore been required. The most logical system, and one to which a number of our present units of measurement can be traced, was based on the proportion of various members of the body and other standards of size achieved with some consistency by the growth of living things.

With the increase in specialization and the approach of the idea of parts interchangeability, the need for the universal and more exact standardizing of measuring units became apparent. Reference standards were set up to which all measurements were related and secondary reference standards were carried to all parts of the earth in order that a meter, for instance, would be the same in the Fiji Islands as it was in Paris, France. Industry, having adopted universal standards of measurement, set up fixed gages for the various dimensions which had to be measured in its products. These became commonly known as "Go-No-Go" gages, and for a long time served the cause of parts uniformity satisfactorily.

**Fig. 1. Showing the use of a solid type snap gage in checking the diameter and parallelism of the crankshaft connecting rod journal.**

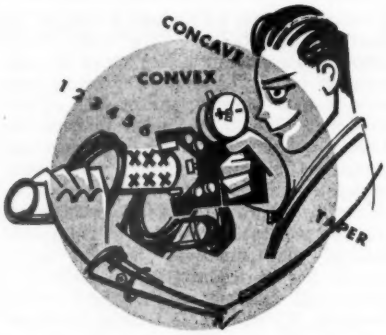



**Fig. 2. Showing the use of an indicating-type snap gage in checking the diameter and parallelism of the connecting rod crankshaft journal.**

But the continued evolution and improvement of mass production methods has resulted in a new need over recent years. It is one which places a different emphasis on the attainment of parts uniformity, and the methods of measurement to be employed. Since extremely high production output can no longer be adequately inspected for quality conformance on a per-piece basis, the present need is for some means of dimensional control in the production process itself. The answer to this is found by the use of indicating type gages.

With fixed type gages of the "Go" and "No-Go" variety, inspection was limited to the segregation of bad production from good. The parts produced by the manufacturing operation were routed

*by* **Roscoe M. Smith**
*Director of Quality Control*
*Ford Motor Company*

| Type of Gaging Equipment | Old Method<br>Standard Thread Plug Gage | New Method<br>Portable Indicating Male Thread Gage |
|---|---|---|
| Original Cost | $8.00 | $250.00 |
| Time required to place in gage, inspect and remove (5000 Applications) | 1200 min | 350 min |
| Time required for repair or adjustment (5000 Applications) | 60 min | 15 min |
| Number of gaging applications before gage is worn beyond adjustment or repair | 5000 | 300,000 |

through an inspection station where they were checked for conformity to the specified dimensions. They were either "Go" or "No-Go"—acceptable or unacceptable. It is in this respect that the modern concept of statistical process quality control is so vastly different. Indicating type gages can measure the amount of dimensional *variation* that is evident between parts produced by the process *at the time of production.* These measurements are like railroad blinkers, warning of impending danger before the crossing is reached—the crossing in this case being the transition from quality production to defective production. This is the kind of protection that has long been sought by industry. It it a reality at the Ford Motor Company.

One consideration, however, that prevents many manufacturers from converting to indicating type gages, is cost. Their argument is that precision indicators are many more times more expensive than are gages of the "Go" and "No-Go" variety, and that an extensive program of conversion would automatically result in vastly increased operating costs. This is an utter misconception.

Consider, for example, the comparative study made in checking the thread of a connecting rod nut for assembly condition, and shown in the accompanying table.

In terms of dollars and cents this represents, conservatively, an annual savings of approximately $3,500 in labor and replacement costs. And of far greater importance are the less obvious savings effected in improved quality and reduced scrap and rework losses.

The transition from "Go" and "No-Go" to the indicating type gaging, and the resultant advantages, is best illustrated by example.

Figure 1 shows the use of a solid type snap gage used in checking the diameter and parallelism of the crankshaft connecting rod journal. In this case, six separate applications of the gage are necessary. First, it is placed on one end of the journal to check the diameter, then rotated 90 degrees to check out of round. This is repeated at the center and opposite end. The great disadvantage of this type of gaging is that it is only possible to determine whether or not the part is within *extreme* tolerance.

The first step toward improved measuring accuracy was accomplished by the adoption of an indicator type snap gage as shown in Figure 2. This gage eliminates the inspector's dependence on "feel" and indicates the presence and direction of any dimensional variation. Since six individual checks still had to be made, however, the inspector was

(Continued on page 96)

Fig. 3. Showing the use of a triple orifice air snap gage in checking the diameter and parallelism of the crankshaft connecting rod journal.

# Profitable Experiences in Quality Control

Our five years experience with Quality Control has shown us that this "tool" properly used will result in better and more uniform products at less cost than can be produced by normal inspection methods. This statement applies equally to our normal peacetime products as well as any items which we are or may be making for defense.

by **Leo Harrington**
Chief Inspector
King-Seeley Corporation
Ann Arbor, Michigan

King-Seeley's numerous products clearly show the flexibility of an effective quality control program. We have applied quality control techniques to the manufacture of automotive instruments, governors, interval timers, instrument panels, electrical appliances, and automotive accessories. We are also applying these same techniques on war contracts with both the Army and Navy.

It is not our intention to try to tell the other fellow how to start a quality control program. The method of introducing a quality control program and its relationship to the manufacturing organization is a controversial issue. We admit we could have approached the task in several ways. The important point is that the methods chosen have worked.

Inspector checking diaphragm depth on electric gage oil pressure plug. Note control charts above inspector.

Operator assembling wires to a-2 burner electrical range. All connections are checked for tightness of nuts by employing torque wrenches and plotting results on average and range chart.

King-Seeley has always enjoyed the reputation of having a good efficient inspection department. Five years ago this inspection department was doing a good job in its assigned responsibilities and in comparison with other inspection departments in comparable industries. We maintained complete inspection reports and summaries. We had excellent gaging facilities and a modern inspection laboratory. Our customer complaint record was more than satisfactory and our field return units were few in number

With inspection operations so satisfactory you would assume there was no desire for improvement. This was not the case. The cost of such inspection control left much to be desired. Competition demanded a reduction in inspection

costs while the buying public still looked for and expected equal or better quality. Statistical quality control engineering as we had been exposed to it seemed to point the way to efficient inspection at less cost, to a reduction in manufacturing scrap, and to the maintenance of an efficient inspection organization.

Management, always alert to possible improvements to be made in manufacturing methods, provided the necessary background. Inspection staff personnel had attended a quality control course given by the University of Michigan as well as numerous quality control meetings and conferences. Procurement of quality control publications and visits to various plants were authorized.

A formal quality control program was established June 25, 1947. The scope of proposed quality control activities was presented to management and approved. The required equipment and necessary personnel were also obtained.

Quality Control was created as a staff function of the Chief Inspector who reported to the Factory Manager. The quality control staff consisted of a quality control engineer, two assistant quality control engineers, and a clerk.

The quality control department was assigned the task of engineering the inspection activity. This group would provide the methods to be used by inspection in controlling quality. They would determine the type of measurement to be used and the necessary records to be kept to analyze quality. In no way was the inspector's job infringed upon or were his responsibilities taken from him.

In August, 1947 we began to introduce quality control in our electric gage department. This was an assembly operation of the electric gas level, oil pressure, and water temperature gage components. We began work on the basic electrical sub-assembly used in the gas level and oil pressure gages.

The inspection data for the last six months were carefully reviewed by the quality control department. All causes for rejection were classified as to intensity and scrap loss. Each operation in the assembly line was carefully examined to determine the exact cause for rejection. The operator, the production foreman, and the inspection foreman were invited to give their views.

All of this was recorded and carefully studied by quality control. Sub-lots of production were sent thru the line to check the various opinions and to prove or disprove the given explanations. Thus the true facts were obtained. These facts were presented to production, inspection, tooling and engineering, with recommendations as to what should be done. Methods were changed, tools were corrected or redesigned, specifications were changed or made more clear. As a result the rejects were reduced substantially.

As soon as the production operator saw something being done to remove the cause of rejections from her job she naturally put more effort into controlling the items she was fully responsible for. The quality control engineer was her friend. He was getting action on complaints she had registred many a time to her foreman without getting action.

As each operation was corrected quality control established inspection procedures to maintain control. Lot by lot sampling, and average and range control charts were the statistical quality control tools used.

The results of all this work were not surprising. For years we had found

*(Continued on page 200)*

**Assembling electric gage gas level unit diaphragm assembly. This operation is controlled by an average and range chart.**

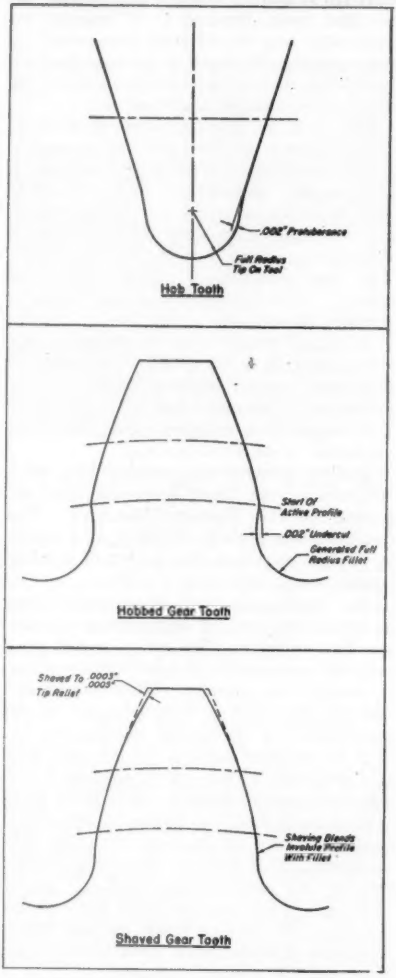
# Gears of Exceptional Quality*

During the past two years Nash has been producing synchro-mesh transmissions of exceptional quality for the Statesman model. Although quietness has been the major objective, a partnership of engineering and production activities has made possible an important improvement in durability as well. These results have been achieved by virtue of some interesting modifications in gear tooth form, application of Red Ring crown shaving, and the development of specially designed cutters for hobbing, shaping and shaving.

Behind these major developments is a program of quality control which has been projected into every operation in the transmission department, starting with the basic materials. The quality control methods, coupled with new cutting tools, have made it possible to produce transmissions of exceptional quality without relying upon entirely new machinery.

*by* **H. S. Gist**
*Master Mechanic*
*Nash Motor Division*
*Nash-Kelvinator Corp.*

Quality control starts with the material specification, gear steels being checked at the source by the metallurgical department. Similarly, forging practice is held under careful control to assure proper metal density, development of grain flow and close control of forging temperature. Heat treatment of machined parts also is subject to control. All heat treating is done in modern controlled atmosphere furnaces with emphasis on maintaining furnace temperature within close limits and accurate




**Showing the elements of gear tooth modification described by Mr. Gist. Top view represents the hob tooth with protuberance and full tip radius. Center view shows a hobbed gear tooth with undercut and full fillet radius generated by the hob. The lower view shows a shaved gear tooth with a fillet-involute blend and tip relief.**

*Acknowledgment: For this article, so appropriate to our 4th Annual QUALITY CONTROL Feature Issue, we wish to express appreciation for the courtesy and cooperation of Chilton Publications' Editor James R. Custer. It first appeared in "Automotive Industries," May 15th, 1951.

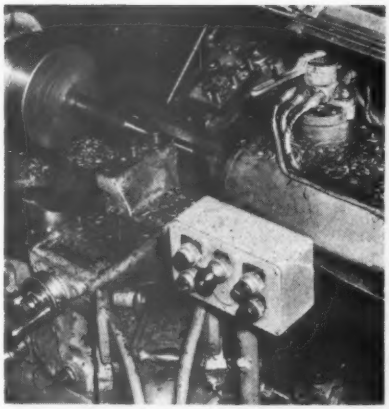
timing of furnace cycles.

Gear tooth modification and crown shaving, which contribute largely to the results achieved here, are translated in practice through the use of Barber-Colman hobs of special design, Fellows shaper cutters of special design and specially designed circular shaving cutters for Red Ring crown-shaving machines. Several Barber-Colman vertical gear hobbers of late design, used on some of the gears, make it possible to employ triple-lead hobs to speed productivity materially.

Finally, quality control is assured by the adoption of inspection methods designed to give "master" gear quality. Basic control stems from the gear laboratory which is equipped for inspecting gear cutting and shaving tools, and for making regular sampling inspection of production gears to verify and approve each new setup. On helical gears, lead is checked by means of a Red Ring lead checking machine; involute form is verified on an Illinois inspection machine; while noise is checked in one of the new Red Ring gear speeders.

It is noteworthy, too, that when sample gears taken from a new setup are to be inspected in the gear laboratory, they must conform to master charts taken directly from the characteristics of the gear cutters and shaving tools.

Supplementing this basic laboratory control are routine inspection methods including sound testing of all gears.

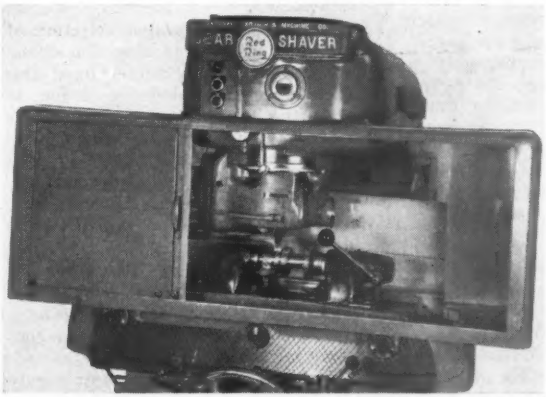


One-half of the transmission main shaft is being finished-turned, in one setting, from the full diameter bar. This view gives an idea of the great rate of metal removal with the single-point carbide tool. This operation is performed in one of the Monarch Monomatics, equipped with automatic tracer control.

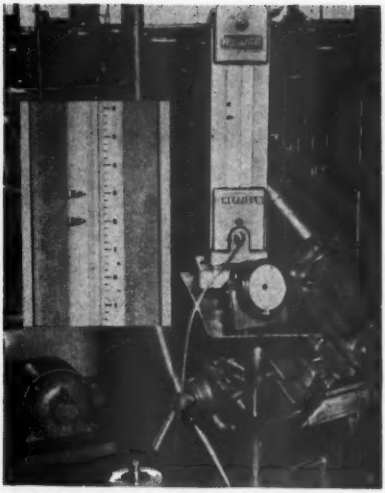
Since sound testing is an exacting procedure, only a little additional time is required to select properly matched sets of gears for a transmission assembly. For this purpose, inspected gears are placed on a rack, after acceptance, and mating gears mounted on the same rack in a parallel row. The matched sets then are kept together for purposes of final assembly.

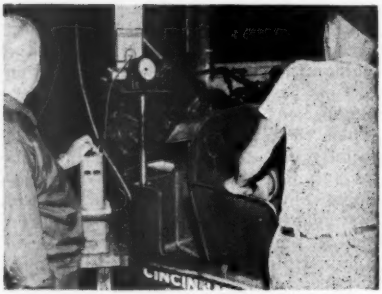
The modification in tooth design are of unusual interest since they combine some of the latest principles known to the art. In the first place, all gears are

(Continued on page 74)




Close-up (with guard open) of Red Ring gear finisher with circular cutter for crown-shaving Nash transmission gears. Shown in this view is the shaving of a countershaft cluster gear.





The operator end-feeds each piece through the grinder for a predetermined duration of wheel contact. The stop clock signals the finish of each grind. The inspector checks the finished work in the airing ring of the Precisionaire indicator. (Left) Stop clock and Precisionaire gage. Indicator scale with preset limit markers (see inset) forms a control chart or toolwear chart. The indicator "chart" plus "alarm clock" permit control of the toolwear cycle to the extremely tight specification.

# Controlling Precision Grinding

by R. E. Penney

*Quality Control Supervisor*
*The New York Air Brake Company*
*Watertown, New York*

During the last few years, manufacturing plants engaged in fabricating parts to modern design and tolerances have been compelled to production-grind both internally and externally to .0001" tolerances or less; and in many cases to a three micro-inch finish. Such tolerances were necessary in our case to enable hydraulic pumps to operate successfully up to 4200 rpm at 3300 psi pressures, and in order to meet complete interchangeability requirements. Of course, with thousands of such parts being processed weekly, production grinding procedures had to be improved as to tolerance and finish capabilities, thus taking the place of slower lapping processes.

Here is the story of how one such component was fabricated and successfully put on a high production basis in our factory.

### Centerless Grinding

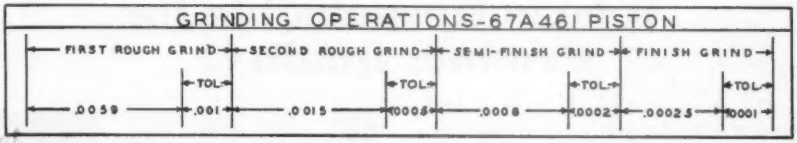
Various pistons running from .2813" to 1.212" O.D. with lengths of .704" to 4.105" had to be held to .0001" tolerance on the O.D. and to 25 millionths taper and out of roundness, together with a maximum of 3 micro-inch finish. The supplier of the grinding machines felt that the normal capability of the machine was .0003", which meant that some additional method of control had to be used in conjunction with our grinding operations.

It was found that proper selection of the grinding wheel, and precision dressing of the wheel at predetermined frequencies were necessary in order to maintain the 3 micro-inch finish. It was found necessary to produce the desired finish at the same time that final size was attained because any additional lapping would not remove material consistently in millionths, at a sufficiently rapid rate.

The nature of the job called for the selection and use of the best coolant.

Steps were taken to insure maintaining the grinding machine in good condition at all times.

The project called for the most highly skilled grinder operators and experi-



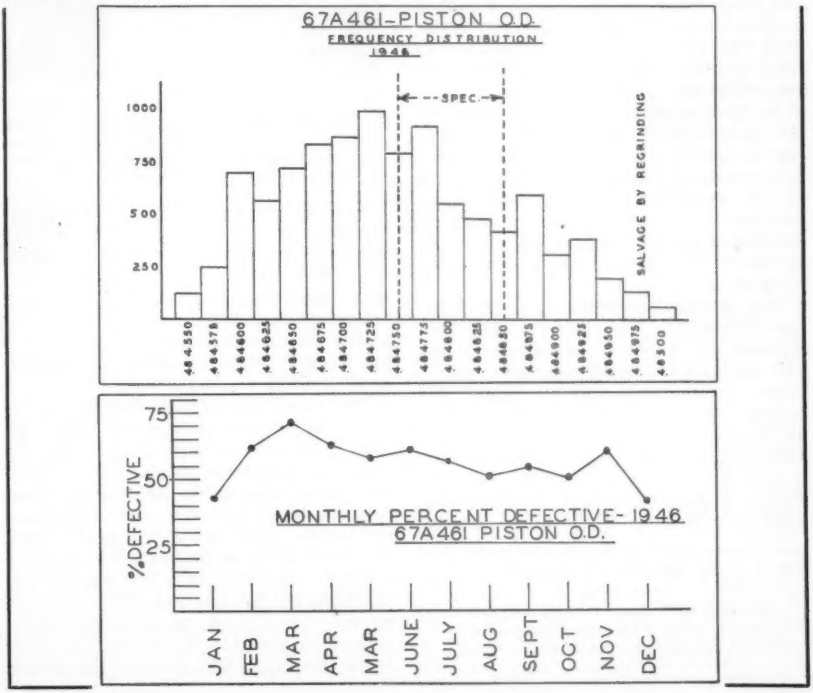

enced supervision.

The parts as fed to the machine had to be more uniform in those characteristics of finish, size, taper, and out of roundness, than previously. This meant establishing three progressive steps of grinding after heat treat and before finish grinding. These followed one grinding operation before heat treat. The several grindings form the desired characteristics progessively, as noted in the accompanying tabulation, "Grinding Operations."

The above steps brought only approximately 60% of the production parts to the .0001" tolerance. Therefore, our next step was to incorporate some form of quality control charting in conjunction with the time cycle of the wheel contact, together with end-feeding of the machine. A step clock was mounted on the machine in front of the operator, so that he could measure in seconds the duration of wheel contact, which of course is con-

*(Continued on page 72)*

**(Above) Chart of successive grinding operations, after heat treat, through finish grind. (Below) Frequency distribution and percent defective characteristics of one piston O.D. in 1946. This same operation and workpiece is shown for 1950 on page 72. Improvements in quantities within specifications and percents defective are most outstanding.**



# Who is Responsible for Product Quality?

The question of who is responsible for quality—the foreman or the inspector—is a very real one in industry. On the surface it may seem an academic question. For purposes of management, however, determination of who should be held responsible for poor quality is an important problem: the foreman ordinarily does not inspect the product; and, the inspector does not make it.

Before analyzing the inspection function, it should be agreed that inspection is a sorting operation and is performed for the purpose of segregating the product into one of two categories, "Acceptable" and "Not Acceptable." Inspection performs no operation on the product: it does not alter form, shape, or appearance. It merely evaluates product quality for purposes of acceptance or rejection.

This view of inspection does not overlook the function ordinarily known as quality control. What has been said about inspection may be said about quality control. Quality control is merely a system of INSPECTION, ANALYSIS, and ACTION applied to a manufacturing process so that by inspecting a small portion of the product currently produced, an analysis of its quality can be made to determine what action is required on the operation to maintain the desired level of quality.

Any quality attributes or characteristics existing in the product have been placed there during its processing. From this analysis of the problem of responsibility for quality was developed the slogan "QUALITY MUST BE BUILT INTO A PRODUCT: IT CANNOT BE INSPECTED INTO IT."

The foreman is responsible for producing a quality product, and any censure, or criticism, for failure to produce a quality product must be aimed at the foreman. The foreman's responsibilities include: (1) provision of proper instruction for workers; (2) provision of correct tools, materials and manufacturing information; (3) assignment of the right man to the right job; (4) instillation in the workers of a feeling of the importance of doing a good job.

The inspector is responsible for evaluating quality — determining what the quality is—and comparing this with the specified quality standards. If the product meets the quality standards specified, it is allowed to move to the customer or to the next operation as required. However, if the quality is substandard to a degree that will make the product unsatisfactory to the customer, or will necessitate further processing without correction, the inspector must take steps to earmark it to take it out of the stream

*by* **Joseph Manuele**
*Director*
*Headquarters Quality Control Dept.*
*Westinghouse Electric Corporation*
*Pittsburgh, Pennsylvania*

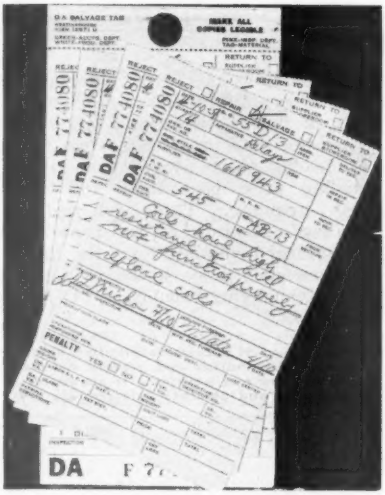



**Fig. 1. On the DA-Salvage Tag, the inspector notes identification of the part and describes the defect in detail. Carrying the signatures of foreman and inspector, the tag keeps the part out of production until defect has been corrected to inspector's satisfaction.**

of production.

For this purpose, the DA-Salvage Tag shown in Figure 1 is a very satisfactory tool. The tag is made out by the inspector. On it, the inspector shows the complete identification of the part or apparatus. He also describes the defect in detail. Both the inspector's signature and the foreman's signature must be affixed on the tag before it is attached to the rejected part, or apparatus.

Once this tag is attached to any rejected part, or apparatus, the material is kept out of production until the defect has been corrected to the satisfaction of the inspector. Of course, a "right of appeal" from the inspector's decision is given the foreman. This prevents any unreasonable or abritrary decisions on the part of the inspector, and effectively places the responsibility where it belongs. The foreman is held responsible for quality of product and the inspector is held responsible for properly evaluating product quality and keeping subquality products from leaving the department.

Since defective parts are rejected by both the inspector and foreman, both have to signify their agreement to any necessary salvage or repair action which may be taken.

The DA-Salvage Tag also forms a basis for authorization of repair operations. All repair-work tickets and material requisitions issued for the purpose of repairing rejected parts must show the DA-Salvage Tag number as authorization for such expenditures, otherwise the Accounting Department will not allow them. If the parts cannot be repaired and must be scrapped, the cost of such scrapping is calculated on the DA-Salvage Tag by the Accounting Department and, in this respect, it serves as an accounting of original entry.

Operation of this policy of defining responsibility for quality has resulted in improved product quality and reduction of defectives. The foreman understands his responsibility and authority; he knows that the inspector has the last word in regard to quality. This leaves the foreman with complete authority for operating his department and, at the same time, it protects product quality because the inspector can exercise his prerogative to "DA-Tag" any products which fail to come up to the specified quality standards.

The DA-Salvage Tag forms a part of the financial accounting system, and once it is initiated by the inspector must be allowed to clear in accordance with prescribed accounting procedures. Since it has the weight of accepted accounting procedures back of it, it forms an effective tool that the inspector can use as required to protect quality.

★ ★ ★ ★ ★

## Your Blood Saves Lives

The high casualty figures for American forces in Korea have created an urgent need for blood plasma and have prompted the Department of Defense to order a special Armed Forces Blood Donor drive for 300,000 pints of blood monthly for the next ten months. Present donations fall far below this figure—in June, only 50,000 pints; in July, the offers dwindled to 36,000.

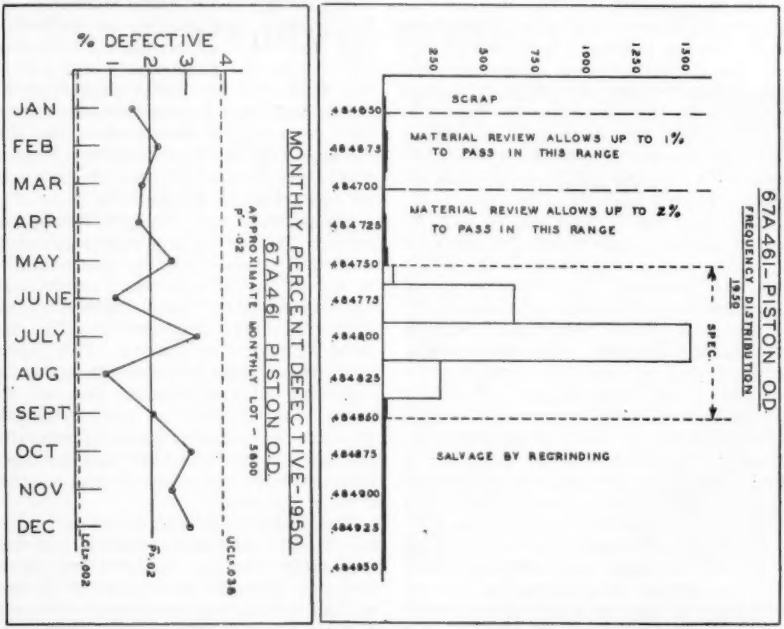
The 3,500,000 troops now in the Armed Forces will be asked to give half of the total blood reserve. The remainder must come from the civilian population.

The paramount importance of this program is shown by the effect of the increased use of the blood reserve in keeping the wounded alive. In World War I, out of every 100 who were alive when they reached the most advanced surgical hospital, eight died. In World War II, the percentage fell to 4.5. In Korea, it has been 2.6.

General George C. Marshall has made the following appeal: "Please call your Red Cross Chapter or Blood Donor Center and make an appointment for donating your pint of blood. Facilities have certain capacities, and if everyone attempts to crowd in at the same time, some people are going to be denied the opportunity of doing their share in giving blood for our Armed Forces.

"If every American will give three pints of blood before next summer, our immediate problem will be solved. But it must be done in a systematic manner. Red Cross and Blood Donor Centers can accommodate only a certain number of people at any one time, so—please call them before going down to the Center to donate blood. And then, most important of all, keep your appointment. Remember—you can't transfuse a promise."

. . . Precision Grinding, from page 69




trollable by the operator. To determine the number of seconds the wheel must contact the work, a linear scale Precisionaire indicator with 10,000-1 magnification was installed adjacent to the time clock together with its "airing" or gaging ring.

Now, as the parts are semi-finish ground to a .0002" tolerance they are segregated into four groups, so as to maintain as uniform a size as possible within any group of pistons being fed to the machine at one time. This makes possible a more uniform timing or duration of wheel contact, thus producing a large percentage of the parts well within the .0001" desired tolerance.

After the grinding operation is set up, each piece as it is removed from the grinder is placed in the airing ring and the linear indicator scale tells the operator just where within the tolerance the parts are with the particular timing he is using. As the parts gradually build up in size, toward the maximum, he increases his timing in seconds, thus bringing the parts back to the desired nominal. This adjustment or time-compensating procedure is repeated as the wheel breaks down, until it is necessary to redress the wheel in order to maintain finish and for size. The factors of taper and out of roundness, being common characteristics of the setup, are only checked once every 25 pieces. Also, different time intervals have to be used as different subgroups (the four originally segregated) from the semi-finish grind are fed into the machine.

As progress was made in the mechanical setup and as increasing skill was projected in the overall procedure, we were able to run 98% of the pistons within the .0001" tolerance, excluding setup loss, and with less than one-half percent overall scrap.

The accompanying "Frequency Distribution" and "Percent Defective" charts show a typical 1950 run through our plant as compared to five years ago.

# A Cost Reducing Combination

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ne style of sliding clutch, manufactured by a rominent eastern corporation, required six milled ots. To keep the cost of the operation in line ith production, Cincinnati Application Engineers oled up a CINCINNATI No. 1-12 Plain Automatic illing Machine with a two-spindle automatic dex fixture and suitable cutters, ready for pro-uction. In addition to the obvious advantages of utomatic indexing and milling two parts at one me, there are four advantages in this machine hich are not apparent in the photograph.

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*rt name* . . . . Sliding clutch
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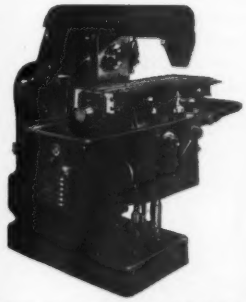
*peration* . . . Mill six slots
*tting speed* . 82 feet per minute
*ed* . . . . . 9 inches per minute
*oduction* . . . 38 per hour
*uipment* . . . CINCINNATI No. 1-12 Plain Automatic Milling Machine, with tooling by Cincinnati

Many other standard features of value in performing 3 hp milling operations at low cost, on parts made in large or small quantities, are described in catalog No. M-1555-1. May we send a copy to you?



NCINNATI No. 1-12 Plain Automatic Mill-g Machine. Complete information on all atures and their benefits may be ob-ined by writing for catalog No. M-1555-1.

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. . . Gears, from page 67

shaved on Red Ring gear finishers and one gear of each pair is crown-shaved (elliptoid form). The amount of crown-shaving is 0.0004" per side.

Another outstanding feature, employed by Nash, is the development of a full-radius fillet at the root of all gear teeth in Nash transmissions. As a corollary of this design element, the whole depth of the tooth is only 0.020" greater than standard. Adoption of the full-radius fillet has increased the strength of gear teeth materially and gives assurance of freedom from breakage or failure due to unusual loading.

Finally there is a third element of design in the nature of tooth profile modification and also fillet relief aimed at facilitating the crown-shaving operation. This amounts to a "protuberance" undercut of 0.002" on the flank of the gear tooth from the radius to the start of the active profile.

The combination of these special design features results in unusually quiet gear trains, free from edge loading of gear teeth under unusual load conditions which may cause momentary shaft deflections, and durability of salutary character.

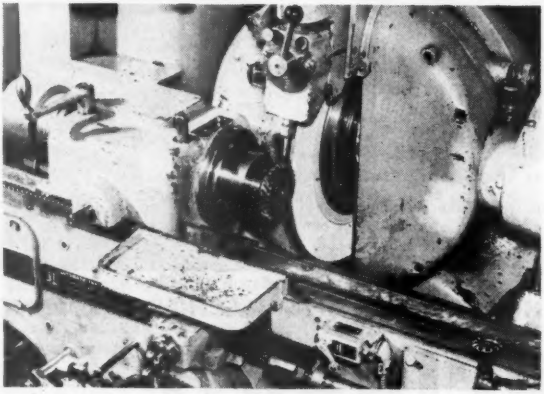
Coming to the details of some selected parts, it is of interest to comment on the machining of the transmission main shaft. Made from NE 8620 bar stock, it is chamfered and cut to length in a Cone four-spindle cut-off machine, then centered. The most impressive operation is the rough- and finish-turning of the entire shaft in a battery of two Monarch Monomatic lathes, the job being done directly from the full rough diameter of the bar.

The first machine finish-turns one half of the shaft, and the work is then transferred to the second machine for finishing the remaining portion. Typical of Monomatic cycles, each machine is fitted with a tracer attachment working from flat steel master templates mounted on the side of the bed. Cutting is done dry and is extraordinary in many respects. For example, spindle speed is 1249 rpm and surface speed 544 fpm with a feed of 14" per minute. Depth of cut is quite heavy—ranging from a maximum of $\frac{7}{16}$" to a minimum of $\frac{1}{8}$". As is well known, a feature of these machines is the use of a single point carbide tool which makes for flexibility of setup.

The low and reverse sliding gear has been selected as an example of a single face gear of some intricacy, having a six-spline helical bore and a shifting collar. Made from drop forgings of SAE 4640 fine grain steel, the parts are bored and reamed in a chucking machine, the spline bore being green-broached in an Oilgear broaching machine. The part is then rough-turned and finish-turned in two 12" Fay automatic lathes.

Next follows the semi-finish cutting of 29 helical gear teeth of 8-10 DP in No. 8-10 Barber-Colman vertical type hobbers. Possessing adequate power and rigidity, these machines make it possible to use triple-lead hobs which are instrumental in boosting productivity. Gear

(Continued on page 78)



J & L thread grinder modified to serve as a form-grinder is set up for finish-grinding the groove in the sliding gear. A special formed wheel performs the operation by a single plunge cut.

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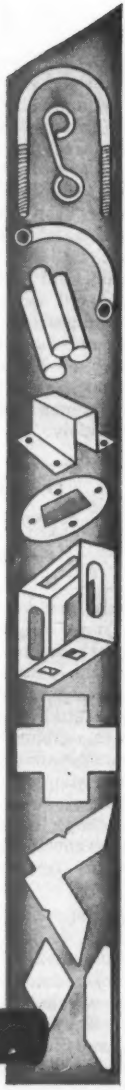

# High Speed Photography Applied to Production Quality

There has been exhibited recently a high speed motion picture camera which can be applied to production problems. It was interesting to note that when this camera was shown at the recent Quality Control Show in Cleveland that over half of the exhibitors possessed this camera in their shops or laboratories. In the case of a later show, held in Houston, Texas, by the Instrument Society of America, but one of the exhibitors had high speed cameras for the study of parts in process. It seems unusual that where one is attempting to produce a product of higher quality, better performance, and longer life, that high speed photography has not been used more widely.

by J. H. Waddell

*Manager, Fastax Division*
*Wollensak Optical Company*
*Rochester, New York*

There are today approximately 1,250 high speed cameras in use by industry and government agencies for the study of actions which are occurring too fast for the eye to see. High speed photographic studies are made of everything from the explosion of atom bombs to the simple operation of piano hammers striking the strings. Where atom bombs are studied, up to sixty or seventy cameras of the high speed nature may be used simultaneously, while in the study of piano strings, only one camera will be necessary.

High speed photography is extremely valuable in studying malfunctions and erratic action where the Stroboscope is unable to catch the action. The stroboscope, which is a pulsating light source, will pick up regular actions, but if there is a malfunction once in a while the Strob. fails. Contrary to this, if a camera is photographing the action, and if there is a slight bit of chatter immediately after the major action, that chatter is detected on the motion picture when it is viewed on projection, or by visual frame by frame analysis.

One of the most interesting examples that has been seen recently where high speed cameras were not used, but could be used, was at the plant of the Hershey Chocolate Company in Hershey, Pennsylvania. It was observed that approximately one percent of the chocolate buds, as they were wrapped, were rejected for improper wrapping. A rejection rate of one precent is reasonably high, and it is felt that the wrapping studies, if made with a camera, would provide a means to reduce this rejection rate to but a fraction of a percent.

A startling example of how the high speed camera was used in production was at a bakery where bread was sliced by machines, and then packaged in wax paper. It was found that the bread was being cut in a rather jagged manner. The general consensus was that the bread was being cut too rapidly, but when high speed pictures were made of the cutting of the bread it was found possible to step up the bread cutting rate three times. A cookie manufacturer was able to increase the packaging rate of his cookies by a hundred and seventy-five percent. It was found that his wrapping processes could be easily stepped up with no malfunctioning of the equipment.

What the production and design men are concerned with, as well as the shop superintendent, is the use of high speed photograph in the machine shop. Very little is known about the behavior of prime machine tools. Before the war, a study was made for Allegheny Ludlum Steel Company in their plant of a number of these machines with particular reference to the machining of stainless steel, and the punching of silicon steel, which was to be used for transformer laminations. These early studies have been released as a picture by the steel

*(Continued on page 80)*

# Hjalmar Ellstrom

## *INVENTOR OF THE GAGE BLOCK*

The achievement of perfection . . . the mastery of any art, craft, or science . . . is a rare human accomplishment. A discovery or an invention that contributes to the total welfare of all mankind is rarely the heritage left by a single man. So rare is it, indeed, that in such infrequent instances, the true facts surrounding its origin are often distorted, or even lost in the conflicting claims of others who would seek the worldly gains to be derived from undeserved fame.

So it was with the Gage Block. For, actually, this basic standard of measurement used the world around was originally conceived and invented solely and entirely by . . . Hjalmar Ellstrom. Here, briefly, is the story of his accomplishment:

During the early 1890's Hjalmar Ellstrom was employed by the government rifle factory at Eskilstuna, Sweden. He was a master craftsman . . . a man of infinite patience who took great pride in his work. He was a man of vision, too, who recognized the limitations imposed upon industry by the lack of sufficiently accurate measuring devices. So, with a then unheard of standard of precision as his ultimate goal, he alone developed and perfected his checking instruments and techniques . . . then alone he created the world's first gage block accurate to the infinitesimal millionth part of an inch.

Today, though his achievement has been copied and imitated by others, his personal unqualified devotion to accuracy is the exclusive heritage of Ellstrom . . . *now measuring in millionths for three generations.*

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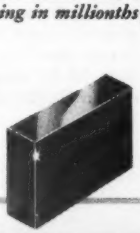


. . . Gears, from page 74

teeth then are rounded in a No. 50 Gross chamfering machine.

Following washing in a Blakeslee Niagara washer, and burring, the gear teeth are finish-crown-shaved in National Broach gear finishers, using a modified circular cutter.

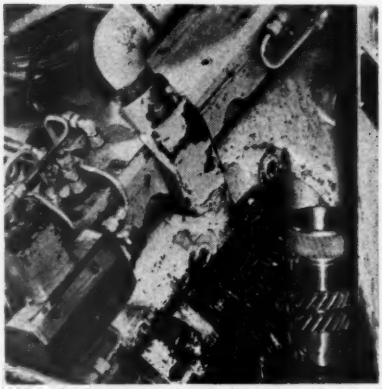
Work is washed again, placed in suitable fixtures and transported to the heat treating department for gas carburizing. Carburizing is done at a temperature of 1500-1550 F to obtain a case depth of 0.006-0.008", then quenched in oil. It is also tempered to secure hardness ranging from 52-57 Rc (min.). After washing, the gears are processed through a Tocco induction heating machine to draw the internal spline to a hardness of 30-40 Rc to permit final hard broaching of splines. This operation, performed in an Oilgear broach, holds maximum depth of spline to 1.645", +.0000, —.0015".

Final operation is the grinding of the groove in the collar for the sliding fork. This is done in a J & L thread grinder converted for use as a form grinder. Using a special formed wheel, it is possible to finish-grind the groove with a single plunge cut.

The clutch shaft presents some intricate machining problems since it combines a splined shaft with a 19-tooth helical gear together with stepped bores and clutch teeth. It starts as a drop forging of SAE 4640 fine grain steel, milled to length, centered, then turned in two settings in Fay automatic lathes. The helical gear OD as well as the two bearing diameters then are surface shaved to finished size in a special Red Ring Roto shaving machine.

These preparatory operations are followed by drilling, chamfering, forming and green grinding of the thrust face and stem. Gear cutting is done in Fellows gear shapers. The first operation is to finish shape the outer group of 24 teeth, then the semi-finish shaping of the 19 helical gear teeth.

Next follow—cutting of the snap ring groove, chamfering the 24 teeth in a Cross machine, washing, and finish cutting of 10 straight splines on the stem end in Barber-Colman and G&E hobbers.



**Above is a view of the work-station of one of the heavy duty vertical Barber-Colman gear hobbers for cutting transmission gears.**

At this point the 19 helical gear teeth are finish-shaved in a Red Ring machine, washed and prepared for heat treatment. This is done in Holcroft gas carburizing furnaces where the fork is held for 1½ hours at 1500-1550 F, quenched in hot oil and tempered at 375 F for 1½ hours. Gear tooth hardness is held to 52-57 Rc.

The shaft is straightened and made ready for a schedule of finish grinding operations which include: grinding of the bearing, oil seal and pilot diameters; grinding the 7° and 25° angles in Norton grinders; and grinding the ID in a Heald internal grinder. The 7° taper at the end is superfinished in a Gisholt machine to five microinch, while the oil seal diameter is held to a finish of 15 micro-inch.

It is noteworthy that in keeping with quality control, each of the Red Ring gear shavers has been equipped with the Barnesdril magnetic separator to keep the cutting fluid clean and free from even minute particles which might ordinarily mar the finish of gear teeth. This also contributes to longer cutter life.

It is also of interest that the Fellows gear shapers used for cutting the clutch shaft have been modified by the introduction of a special external work holding device which is designed to hold the shaft on centers rigidly and in accurate alignment during the shaping cycle. This feature is instrumental in maintaining high gear quality and axial alignment.

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. . . Photography, from page 76

company, known as "Micro Timing." The picture, as released, did not cover the complete study of tools made during a week, but only the more selected shots which would be encountered in shop work.

Another picture was released by the Warner & Swasey Company showing similar studies. In this, the lathe was one of the most important machines studied. The rake of the tool, the material of the tool, the cutting angle, and the material which was being worked on, as well as the cutting rate, were the major variables. Using a given material, it was found that an increase, or decrease, of normal cutting rates would cause tool chatter and, consequently, a very rough surface.

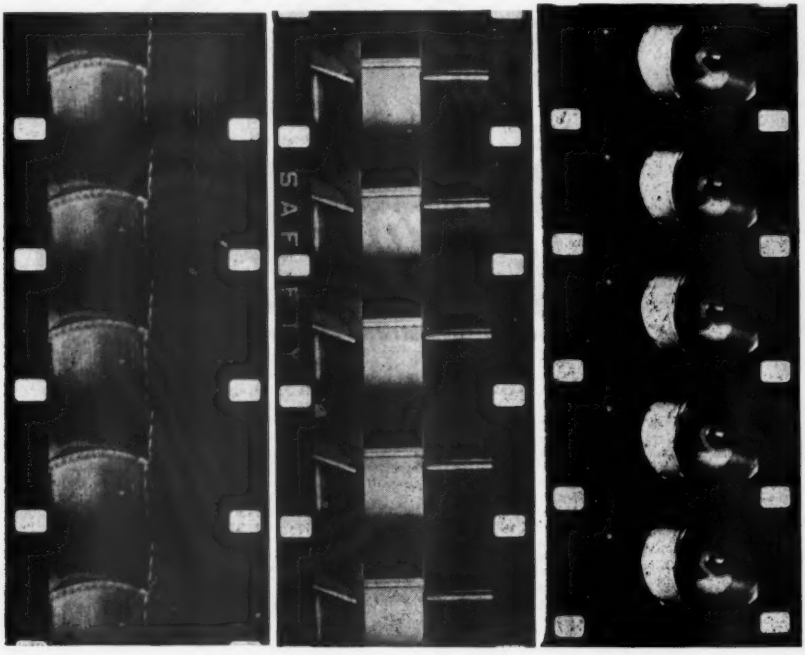
The rough surface, as developed, might be irregular enough to not be of sine wave from, or modification or deviation thereof, but, actually, a jagged, rough cut.

The same conditions would exist when the rake and the angle of the cut were varied.

When the material was varied from stainless steel to brass it was necessary to make adjustments in the tools to get

*(Continued on page 84)*

**Fig. 1. On the left is a sequence of five frames from a high speed photo study of the action of cutting tools. It must be remembered that the vertical movie frame strips are successive shots of the same object or setup; they are separated from each other by a minute interval of time. The five-frame sequence in the center is from the Allegheny Ludlum film study of press tool performance. This particular strip shows the slug about to fall away from the punch. The frames at the extreme right are from a high speed photographic analysis of the action of movie film traveling over a sprocket wheel. It is plainly seen that the film is "climbing" the sprocket. It was found that the film had been perforated at intervals less than the pitch of the sprocket teeth. Such views of arrested motion permit accurate diagnosis of malfunctions which may occur only at extremely high rates of speed or frequency.**



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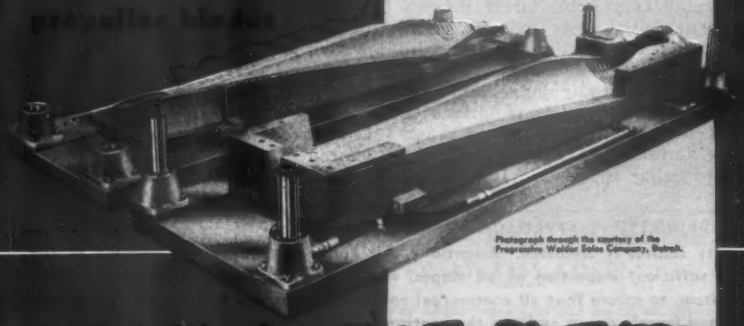

Photograph through the courtesy of the Progressive Welder Sales Company, Detroit.

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# Air Force Quality Control Requirements

The unique position of the Government as a consumer dictates the need for Government inspection of all materiel purchased by public funds. The Government has a responsibility not only of protecting its investments but also of treating as equitably as possible all of its suppliers. Each citizen has an equal right, in open competition, to do business with the Government. He has a right to have his product impartially judged for conformance to specification requirements. And all citizens have the right to expect that the Government gets a fair return for every dollar it spends. It is necessary, then, that the Government inspector supervise the inspection of all materiel which it purchases. Contrary to popular fancy, Government inspection is no bureaucratic vagary. It is a legal requirement which protects the citizen both as a taxpayer and as a competitor for Government business. Government inspection responsibilities are spelled out in "The Armed Services Procurement Regulations," which specify standard inspection articles for all contracts for the purchase of military supplies. Essentially, these articles require the contractor to establish and maintain an inspection system which is acceptable to the Government. Adequate inspection by contractors is a prerequisite to the overall effectiveness of Government inspection. What constitutes an acceptable system is the general topic of this paper. It is well to keep in mind that all inspection under Air Force contracts, whether literally by the Government or under Government supervision, is intended to guarantee that military supplies conform to contractual requirements and that in both quality and quantity the Government gets what it pays for.

**THE PROGRESSIVE APPROACH of the Air Force toward Government inspection and quality control is discussed. Essentially, Air Force contractors are required to conduct sufficient inspection at all stages, from material receipt to packaging of the end item, to assure that all contractual requirements are complied with. Acceptance is based largely on an audit of the contractors' inspection and quality history records by the Air Force Quality Control Representative maintaining surveillance over the contractors' system, rather than on complete product inspection by the Air Force.**

This article is presented through the courtesy and cooperation of the Central Air Documents Office (Army-Navy-Air Force), and is from Vol. 16. No. 7, of the Office's Technical Data Digest.

*by Lt. Col.* **O. C. Griffith, Jr.**

*Quality Control Division*
*Directorate of Procurement and Industrial Planning*
*Air Materiel Command*
*Wright-Patterson Air Force Base*
*Dayton, Ohio*

As a kind of backdrop to an analysis of the Air Force's inspection activities, it might be well to review the basic criticism directed against military inspection during the last war. To keep the ledger balanced, it might be equally well to summarize some criticisms directed at industry by the Armed Services. In general, industry feels that:

1. The Armed Services duplicated contractor's as well as each other's inspection.
2. Many design requirements and specifications were too rigid, ambiguous, or complicated and were excessively at variance with standard commercial practice.
3. The Armed Services relied too much on one hundred percent inspection and made too little use of Statistical Quality Control methods.

The Armed Services feel that:

(Continued on page 86)

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SEE ADVERTISERS INDEX, PAGE 183, FOR KEY NUMBERS

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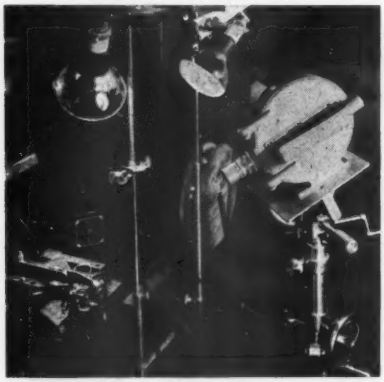


Fig. 2. Allied with the high speed motion picture studies of springs and various spring performance characteristics is this Fastax camera setup for analyzing the functioning of a spring winding machine. The field of view includes the spring wire as it approaches the winding arbor, from the reel in the background, as well as the build-up of the convolutions as the spring takes shape.

a better cutting action.

A series of pictures illustrating the reaction of the cutting tool is shown in Figure 1. These pictures show that the grain structure is being distorted, and that the tool is not working at its best. The material will be observed to be moving at constant rates, but the formation of the chip is certainly an irregular action. In working materials which are being used today, which may be everything from very hard-working invar, through stainless steels, free machining steels, brass, aluminum, bronze, magnesium, to the many plastics, much is to be gained through the judicious use of the camera in studying their machining reactions.

It is not generally known, but in a miller, the cutter acts as a bulldozer when a film of oil is placed over the cutting tool. It will be observed as each little bump takes place (the cutting edge biting into the material) that a pressure wave is set up which will not give the smoothest edge in the world. It is, therefore, noticed that improvement can be made in millers through the use of high speed photography for studying the variables which exist. It might be noted that the variables pertaining to each of the machine tools we are discussing are much alike throughout.

The shaper is one of the weirdest of tools. When pictures are taken in color of the shaper it will be found that the cutter becomes almost red hot from the friction of cutting hard materials. This change in temperature, however, does not too seriously affect the sample being cut, though it might affect the tool, in time. Sequences of high speed camera exposures showed that, initially, the cutting tool performed with a smooth action; later sequences disclosed the material breaking off and chamfering the edge below the surface; the edge where the tool ends its cut.

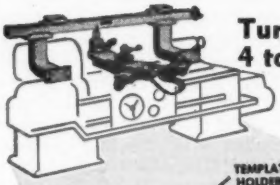
This is involved in a problem that was presented only yesterday, which was the cutting and polishing of metal wherein the edges were required to be prependicular to the major surface. If one had cut the metal as described above, it would not have been possible; but from the high speed pictures it was observed that another piece of metal has to be placed in intimate contact with the workpiece in order to prevent the breakaway.

The drill press is an extremely difficult subject to study in view of the fact that in most cases the drill is going into an opaque material, and, therefore, the action of the drill cannot be easily observed. Drill press studies will show primarily the chip formation. Chip formation to an experienced machinist, however, is a gage as to how good the operation is proceeding.

Among other of the major tools on which not too much work has been done are the punch press and the automatic screw machines. In the Allegheny Ludlum picture, Figure 1, there is a special punch press in which the sides are cut away. It was assumed by the engineers that a given thickness of silicon steel could be used with the tungsten carbide tools which were being used. In the high speed pictures it was shown that the

(Continued on page 202)

# Greatest advance in turning since the invention of the metal working lathe!



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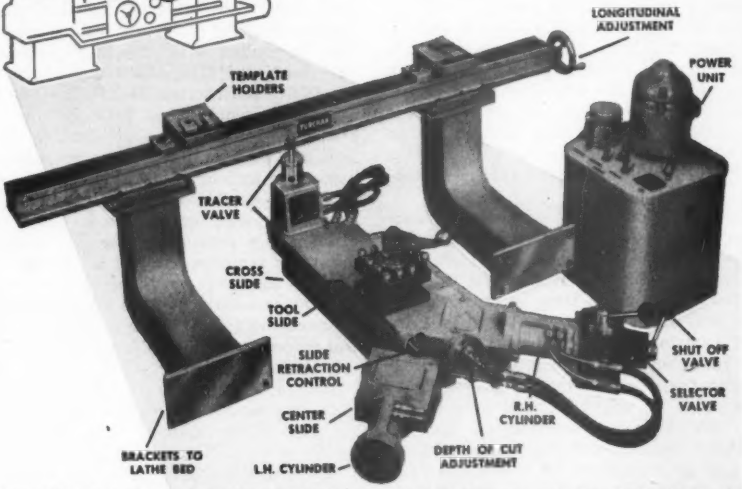


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SEE ADVERTISERS INDEX, PAGE 183, FOR KEY NUMBERS

. . . Air Force, from page 82

1. Industry was often unaware of contract and specification requirements.
2. Many contractors had no satisfactory inspection system and lacked adequate quality history records.
3. Industry was unsympathetic to the introduction or use of modern Quality Control techniques, such as Statistical Quality Control.

It should be pointed out that all these criticisms do not apply to any one industry, or to any one of the Military Services. They represent a cross section and a summary of opinions. However, it will assist in understanding some of the aspects of the AF Quality Control policy, if these criticisms and shortcomings are kept in mind. These points have been recognized by the Air Force for some time. The whole structure of Air Force inspection was rigorously re-examined in theory, in practice, and in organization with the results discussed in the following paragraph.

In August of 1948, the inspection function of the Air Force was separated from the procurement function and the independent Inspection Division was established. A short time later the Division was redesignated the Quality Control Division, in view of the fact that the functions of this organization transcended the field of mere inspection. At this point, it might be well to consider the Air Force's definition of Quality Control. Quality Control is the over-all management function by which the quality of supplies is established, determined, or improved. Inspection is but one of the tools of Quality Control; it is one of the methods by which quality is determined. It is realized that there are many different interpretations and definitions of the terms "inspection" and "quality control" throughout industry. The Air Force does not attempt to impose this definition upon anyone; it merely is stated for the sake of having a common understanding.

About the same time in 1948, the Air Force recognized the need for greater utilization of statistical techniques in inspection, and assigned a Statistical Quality Control officer in the administration office of the Inspection Division. Since that time, the Statistical Quality Control group has grown to a staff of four Quality Control engineers and an independent Statistical Quality Control Office has been established, reporting directly to the Chief of the Quality Control Division.

In 1949 the Stanford Research Institute prepared under contract a comprehensive review of the inspection function of the Air Force during World War II and proposed many recommendations for the improvement of this function. The study augmented the Air Force's own studies and helped to accelerate the reorientation of the Air Force's point of view. The overhauling of the Air Force's Quality Control activities was completed last December with the publication of Specification MIL-Q-5923* and Directorate Office Instruction 74-1.* The former is to be incorporated into future Air Force contracts where applicable. It is intended to amplify the basic contract inspection article which requires the contractor to establish and maintain an inspection system acceptable to the Government. It sets forth the Air Force's minimum requirements for an acceptable Quality Control or inspection system. The latter document is a parallel set of instructions for Air Force Quality Control inspectors. It sets forth their duties for maintaining surveillance over the contractor's Quality Control system. Both documents are direct reflections of the Air Force Quality Control Policy which is quoted below:

"CONFORMANCE: Conformance to contractual requirements of supplies presented to the Air Force shall be determined on the basis of objective quality evidence. Such evidence will be obtained by the contractor and will be evaluated and verified by the Air Force Quality Control Representative exercising surveillance over the contractor's facility. Evidence may also be obtained independently by Air Force Quality Control personnel.

"PRODUCT INSPECTION.

a. Product inspection by Air Force Quality Control personnel will be

(Continued on page 184)

*Latest printings of these publications embody revisions soley for the purpose of clarification.

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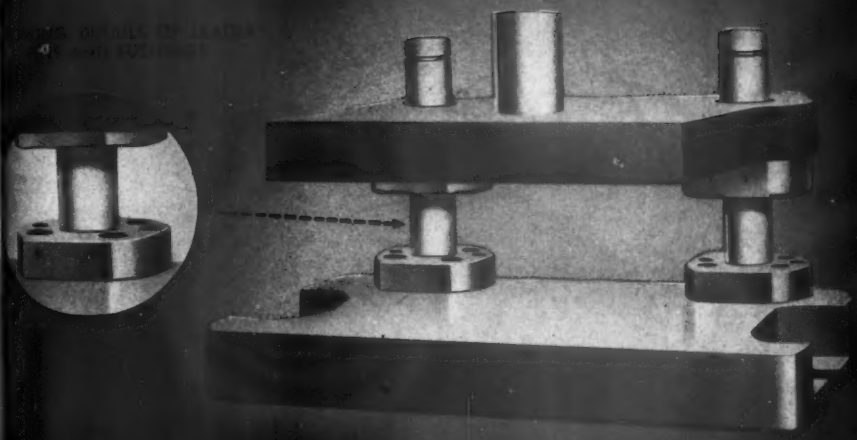

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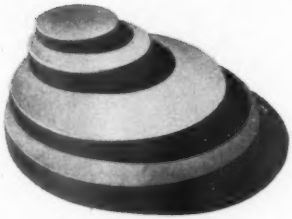

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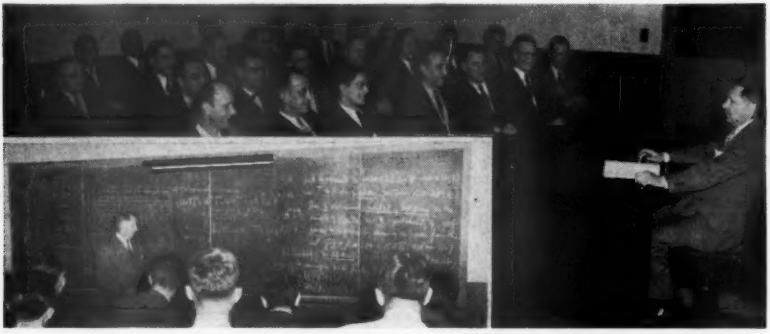

## the Methodological Content of the

# Thompson Training Program in Quality Control

The scope of this report does not permit description of the Thompson Training Program in Statistical Control of Quality except in very general terms. Naturally, if the training is to be of practical value not only to production and inspection personnel but also to sales engineers, to metallurgists, chemists, methods engineers, budgetary control engineers, they all must find it applicable to their specific problems.

### Foundation of Instruction

Consequently, the program is purposefully laid on a wider foundation of statistical method rather than on the restricted basis of dimensional quality control and of acceptance sampling. To be sure, in the quality control program described in this report, those two phases of the statistical method are of primary importance; and since the course is primarily designed to be used as a vehicle for building up interest in and for the introduction (or resumption) of quality control program in the Thompson plants, the basic data used, processed, charted, and analyzed in the course relate to factory problems. However, they do not necessarily represent actual shop data.

On the other hand, depending on the composition of the class, data used in the course are always presented as analogous of such varied values as weekly wages, hourly rates, time durations, electric resistances, strengths of magnetic or electric field, tensile strengths of materials, concentrations of solutions, budgetary expenditures, test grades, etc. Sufficient drill and supervised classwork is given to show the students how to collect, organize, analyze, and interpret the numerical values dealt with in their respective work. Skill in appraising the reliability of estimates based on sampling results is also imparted.

### Reliability of Method

In order to test the reliability of a statistical method, it is necessary to compare the results obtained by the application of that method with the true nature of the statistical universe esti-

*(Continued on page 118)*

by **James V. Strela**
**Staff Statistician**
**Thompson Products, Inc.**
**Cleveland, Ohio**

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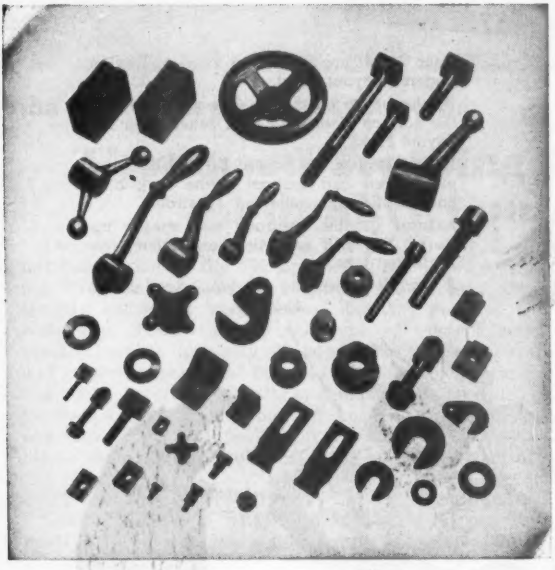

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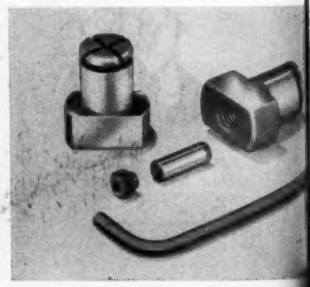

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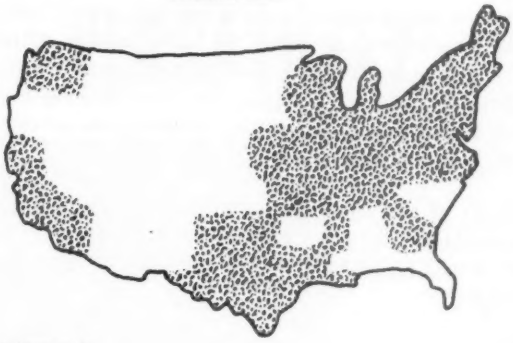

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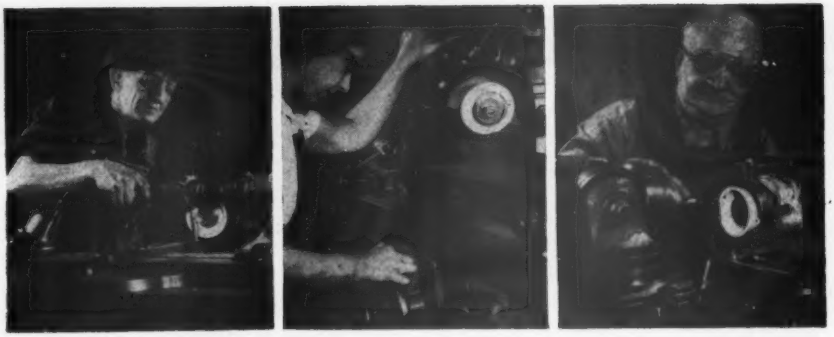

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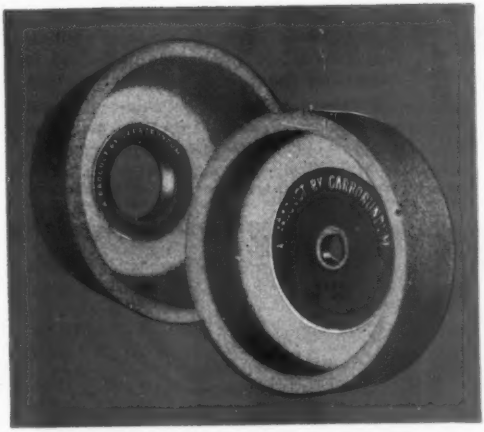

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81-28

SEE ADVERTISERS INDEX, PAGE 183, FOR KEY NUMBERS

. . . Ford, from page 63

faced with the difficult task of remembering or recording, and reconciling, six different dial readings.

The answer to this problem is the triple orifice air snap gage, now used, which requires only one application. This gage, Figure 3, is so constructed that the amount and direction of dimensional variation is measured by the air escaping between the journal and the orifices in the snap. The results are indicated on a triple column dial and remain there until the snap is removed.

Figure 4 shows another interesting example of the old and new methods of gaging. On right-hand end of the machine are displayed the solid type gages formerly used for checking the bearing diameters of the front wheel spindle. Immediately below the control chart is the dial air gage now being used. In this case, as in the pervious example, the snap gages used for diameter and taper checks, and the ring gage used for checking out of round, are incapable of measuring the dimensional variation necessary to the practical application of statistical quality control.

Indicating type gages are also adaptable to forging operations as will be seen in the following three examples.

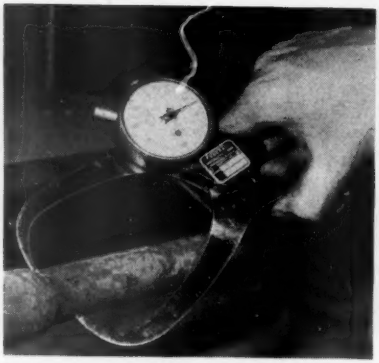


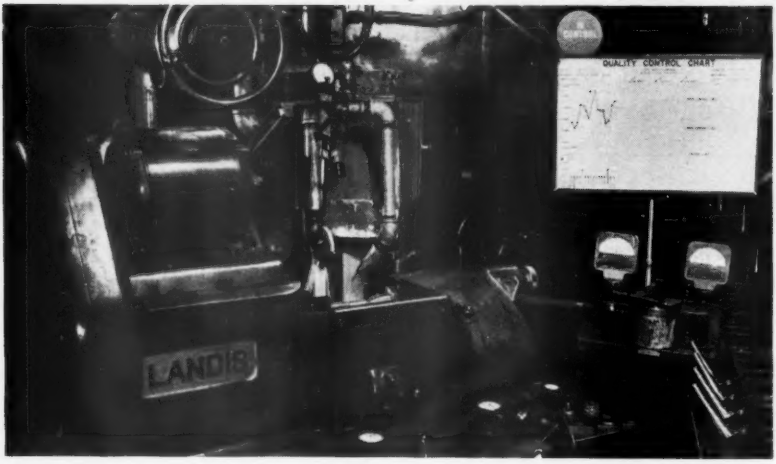
Fig. 5. An indicator caliper for checking diameter of forged shaft. A simple application but an invaluable aid in estimating the wear and life of the die.

Figure 5 shows an indicator caliper being used to check the diameter of a forged shaft. Simple as this application may be, it is an invaluable aid in estimating the wear and life of the die.

Figure 6 shows a somewhat different application of indicating type measure-

(Continued on page 108)

Fig. 4. On the right-hand end of the machine are the solid type gages formerly used for checking the front wheel spindle bearing diameters. Below the control chart is the dial air gage being used.



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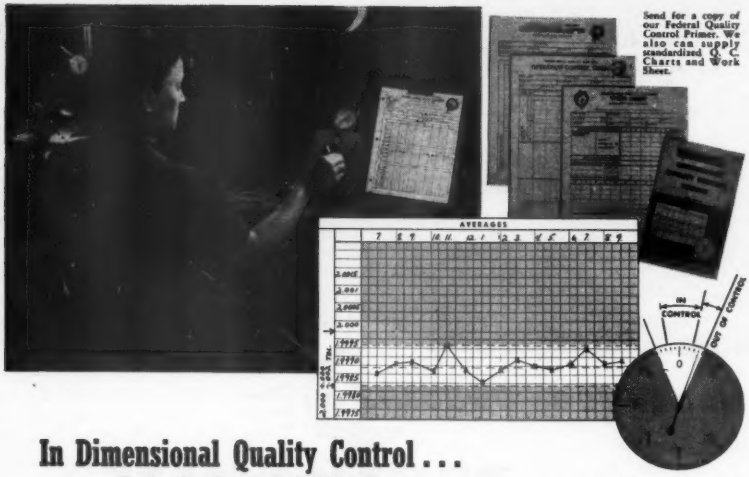
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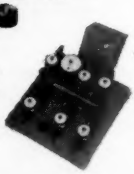

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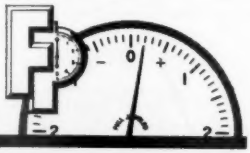

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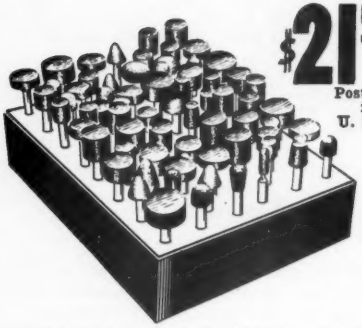

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1 2 3 4 5 6 7 8 9 10 11 12

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| 1. | 1½" | x | 1/4" | 7. | | 3/4" | x | 1/4" |
| 2. | 5/8" | x | 1/2" | 8. | A-61 | 3/4" | x | 1" |
| 3. | 3/4" | x | 1/2" | 9. | A-90 | 1/2" | x | 1/2" |
| 4. | 5/8" | x | 3/4" | 10. | A-41 | 5/8" | x | 5/8" |
| 5. | 3/4" | x | 3/4" | 11. | A-111 | 1" | x | 1" |
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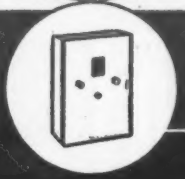

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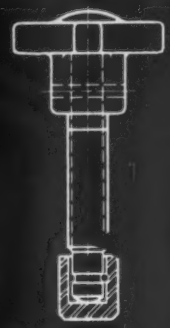

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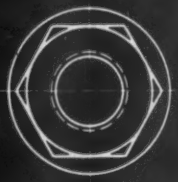

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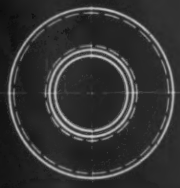

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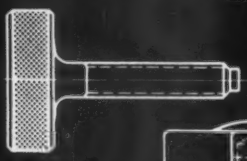

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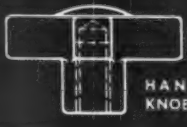

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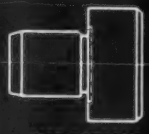

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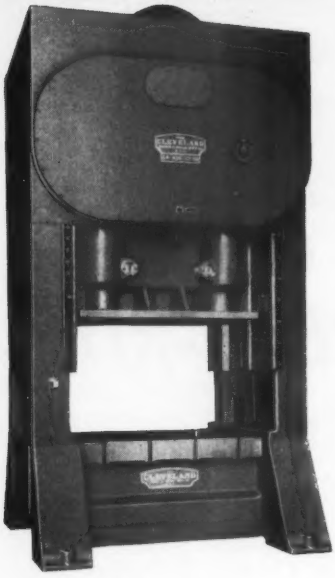
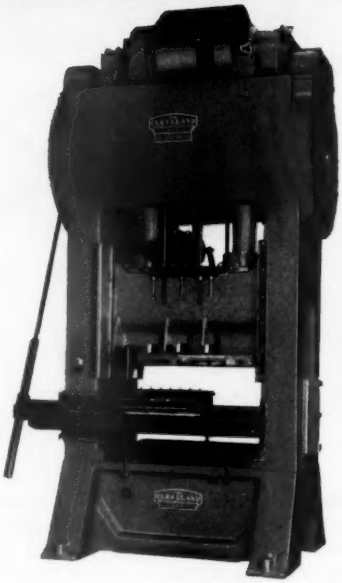


Four Point Press, double-geared with air friction clutch, air counterbalance to slide and air brake on flywheel.



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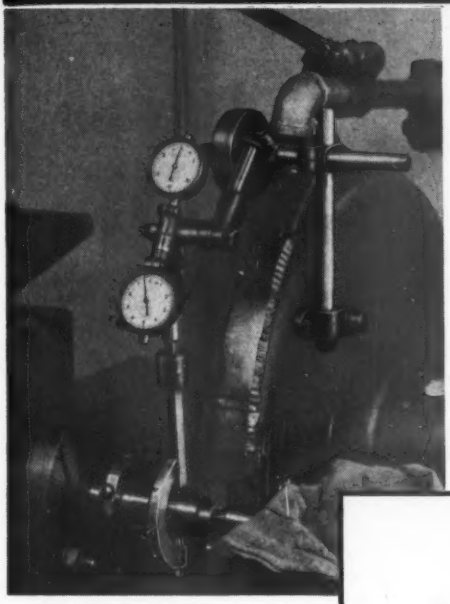

Foster Size Control Gages for external cylindrical grinding machines eliminate any need to stop grinding operation for checking size. Size is automatically indicated at all times on large, easily read indicators. Grinding work over or undersize is virtually impossible. Provided with dual indicators (as shown) to read .001" and .0001", or single indicator reading .0005" only.

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Available in all sizes.

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. . . Ford, from page 96

ment. In this case, the flange run-out (in relation to the center line) of the transmission input shaft assembly is being checked. This gage multiplies the ratio of run-out for easy observation, while the method formerly used consisted of rolling the shaft on a set of rollers and marking the high spots with chalk.

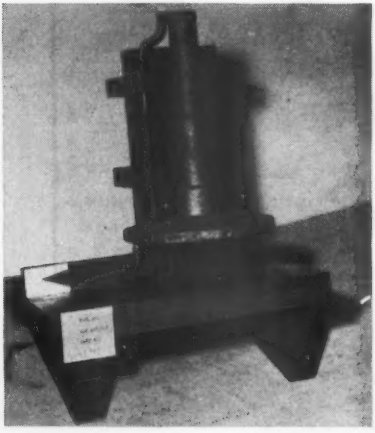
Figure 7 shows the indicating gage used to check the relation of the spindle support king pin bosses to the mounting faces.

The remaining two examples will further illustrate the versatility of application of indicating type gages.

In Figure 8 is shown the test stand which has been developed to check and indicate the performance of a completed automatic transmission assembly under simulated driving conditions. This gage is so constructed that any variation from the acceptable operation of the transmission is automatically indicated. Prior to its development, the transmission assemblies could only be tested for actual performance after they had been installed in the car.

Figure 9 is a unique example of the adaptation of indicating type gages to the testing of body assemblies for air leakage. The purpose of this test is to detect leaks through which dust or rain may enter. In order to do this, all the regular body openings such as doors and windows, etc., are sealed off, and a partial vacuum is created. The values on the gage indicate the amount of air leakage (in cubic feet per minute) entering the body under one inch of vacuum.

Fig. 6. Indicating type gage as used to check the flange run-out (in relation to center line) of the transmission input shaft assembly.



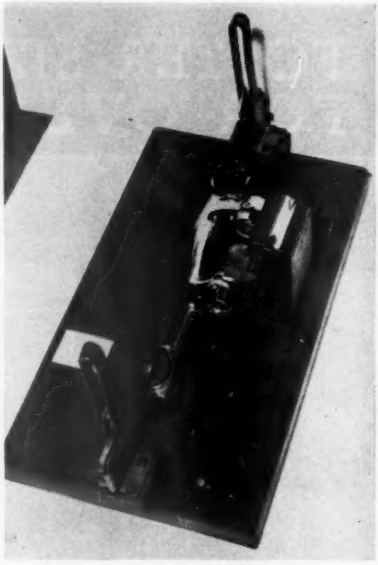
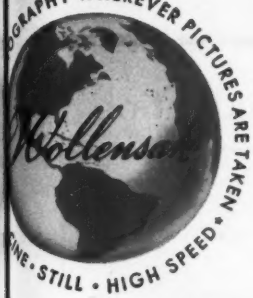


Fig. 7. Another indicating type of gage devised for use in checking the relation of the spindle support king pin bosses to the mounting faces.

The diversified examples cited in this article were chosen in anticipation of the question: "Can I use precision indicators in my operations?" As can be seen, there is little limitation to their uses. It must be said, however, that there is a great deal more to the program of conversion than the purchase and installation of the equipment. A most important pre-requisite is the willingness of the manufacturer to carefully analyze his own particular needs and to engage in such market and scientific research as may be necessary to fulfill them. Then there is also the ever-present problem of assuring acceptance of these new techniques in the shop. These

(Continued on page 209)

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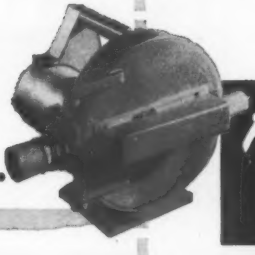

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# Brazed Assemblies for Cost Reduction

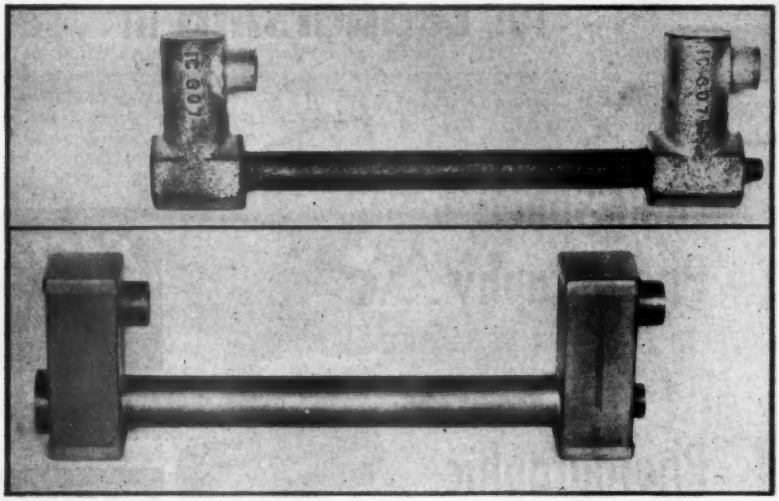

**Fig. 1. The "before and after" gas manifolds. The original job (above) was assembled from castings and pipe stock. The re-engineered product (below) is made up of stampings, and screw machine products, assembled by copper and silver brazing, and boosts a 24% lower cost.**

Designers of relatively light and complex steel mechanisms or of components that normally need considerable machine work are finding in many cases that marked cost reductions can be effected by copper or silver brazing, commonly in continuous or batch type controlled atmosphere furnaces. To gain these advantages, the manufacturer need not be equipped to produce the assemblies in his own plant. A new industry has developed, consisting of several companies who fabricate brazed assemblies to customers' drawings and specifications, and who can supply design assistance based upon their practical experience.

The basic components of brazed assemblies are stampings and screw machine products, inherently low in cost, and largely responsible for the overall economy of the process. Component assembly and subsequent brazing, usually well within allowable cost limits, frequently result in substantial net savings.

*by* **N. M. Salkover**
*Technical Metal Processing, Inc.*
*Cleveland, Ohio*

Experience has proved that large scale production is not required to obtain the benefits of brazed construction. Each job must be analyzed individually, but lots as low as one hundred units have been made with cost reduction of 50% as compared with previous practice.

In some cases, parts such as cams that would require expensive machine work are made economically with little or no machining. Often, the finished assembly is lighter and offers a substantial saving in metal. Castings can be incorporated if essential or if they happen to effect economies, but they are rarely used because the typical member of a brazed assembly is so simple that it can be produced at less cost by other methods.

Examination of specific cases are instructive and support the foregoing statements: One such is shown at the bottom of Figure 1, this being a gas

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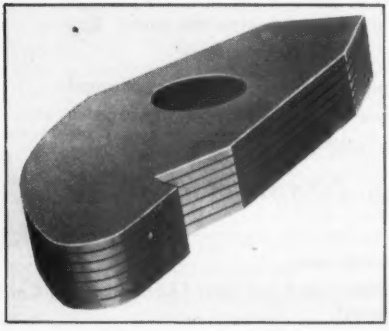
manifold, made of steel and partly copper brazed and partly silver brazed. This is one of the many redesigned cost-saving units which one producer of brazed assemblies suggested and helped to develop in cooperation with its customers.

Initially, the manifold was made from two castings, a length of pipe and pipe plug, shown at the top of Figure 1. The castings were not low in cost and required drilling and tapping. Both ends of the pipe had to be threaded and tight joints were required in two tapped holes in the castings, which then had to be correctly aligned to fit a mating assembly.

Now, each end-fitting is built up by brazing together two small square stamped caps, a wrap-around stamping and two tapped bushings, the latter being low cost screw machine products. These six parts, all very low in cost and needing only simple dies for the stampings, are pressed together and then are run through a continuous copper brazing furnace with a short piece of copper wire placed on each end. Upon melting, the copper is drawn by capillary action into all joints and renders them tight and strong.

All that remains is to join the two end-fittings to the tube. This could be done in the brazing furnace but is performed to better advantage by silver brazing in an induction unit because this permits the use of a single simple fixture

**Fig. 2. This cam is built up by copper brazing several laminations blanked and pierced in a low cost die. Significant dimensions are closely held and machine work is avoided, all resulting in marked savings.**



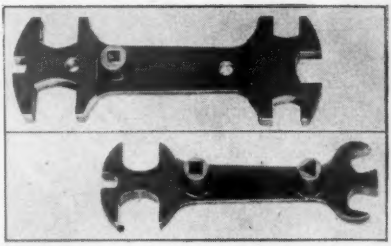


**Fig. 3. A forged wrench (shown below) and (above) an equivalent product made from stampings plus one screw machine element. Assembly by copper brazing yielded a satisfactory wrench.**

that holds the two ends and the tube in correct relative position while the brazing operation takes place.

In this instance, the final assembly is strong, has tight joints and weighs less than that displaced. Aside from making the stampings and screw machine parts and cutting off the tube, there is no machine work. Most important is the reduction in cost, which the customer states is 24 per cent less than that of the original assembly.

To make laminated copper brazed cams such as those shown in Figure 2, it is necessary to blank and pierce the flat sheet steel laminations, this being done very rapidly in a low cost die and with significant dimensions held to 0.002", plus or minus. Brazing the laminations together costs little and the resulting cam is strong and very low in cost because all machining of contours and holes is eliminated. These cams, and others produced by the same company, have shown overall savings up to 50% compared to previous use of castings, forgings or bar stock. Some of these cams are produced economically in lots of only a hundred pieces.

Many laminated parts besides cams, including one-piece wrenches of various shapes with holes and slots to fit bolts, nuts or special shanks, can be made in this way. A typical wrench, now in quantity production, is shown in Figure 3. Only two laminations will suffice in some cases, especially if the laminations are flanged at specific points to increase

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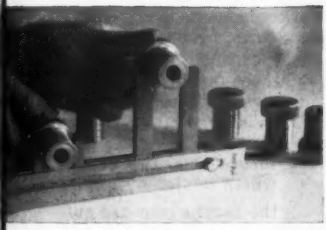

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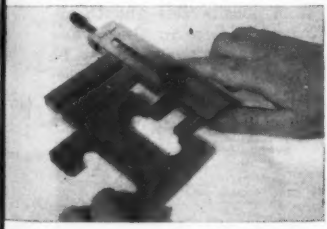

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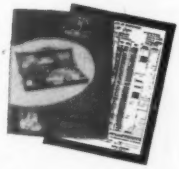

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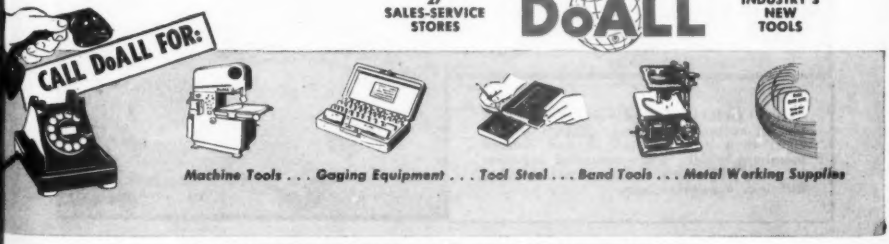


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stiffness or to provide wider bearing faces at wrench holds. A stamped wrench of this type has strength approximating that of a forging but needs no forging die or machining. Overall costs of brazed construction are appreciably below those of conventional design.

Central steel bushings are needed for the type of spring shackle in which the bushing is vulcanized to a rubber ring that takes torsional deflection. In such cases, the steel bushing commonly is made from tubing cut to length and burred or countersunk at each end. Since tubing is expensive, such bushings can be replaced by wrap-around stampings with copper brazed longitudinal seams. Costs range about 15 per cent lower than for bushings cut from tubes. The steel strip from which these wrap-around bushings are formed can be rolled with beveled edges, which, in the finished bushing, provide beveled ends without the necessity for machining.

A similar wrap-around bushing is produced in volume, with stamped and flanged ends pressed on and brazed rapidly at low cost. Such a spool-like assembly is used as a solenoid tube for application in mechanisms for operating automobile windows and convertible tops.

Until recent years, rocker arms for operating overhead valves in automotive engines were forged, drilled, bushed at the pivot, and had one end tapped and faced for an adjusting screw. Today, many such rockers have been replaced by stamped assemblies that include integral bosses for the pivot bushing. Stampings are made either in one or two pieces, Figure 4, and furnace copper brazed through the central plane. The adjusting screw end is formed for tapping and some rockers have coined oil grooves.

In producing these stamped rockers, sets of somewhat expensive dies are required, but considerable economies result, especially through savings in machine work. Moreover, the product answers the same purpose as when forged and machined at higher cost. Parallel developments have resulted in producing stamped camshaft brackets, the components of which are brazed and include one or more oil passages. These brackets compete successfully with cast equivalents.

Other examples might be cited in which assemblies built up from stampings with or without the addition of screw machine components have effected substantial economies, producing, in general, units equal or superior in quality and strength to those displaced and costing substantially less. It does not follow that this technique is universally applicable or profitable but the examples cited are certainly evidence that the benefits gained are well worth while.

In any event, the facts given are sufficiently impressive to make it desirable to study parallel possibilities and to obtain comparative cost figures. Only when this has been done can the designer be certain, as a rule, that he has chosen the better and more economical type of construction.

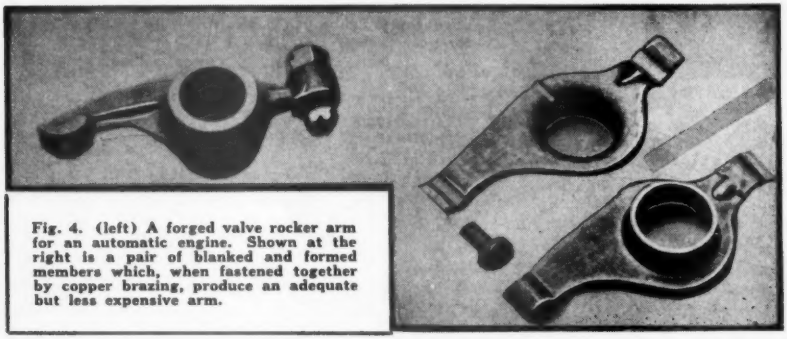

Fig. 4. (left) A forged valve rocker arm for an automatic engine. Shown at the right is a pair of blanked and formed members which, when fastened together by copper brazing, produce an adequate but less expensive arm.

In making the comparison, it is expedient to consult those who have had experience in this type of work, as they are most likely to be best informed about types of design and assembly technique that have produced favorable results. Unless this is done, the designer may easily overlook types of construction deserving of careful study and that may even make the difference between favorable and unfavorable results.

One point in this connection is the possible effect that heating to the 2050° F necessary for furnace copper brazing will have on hardness, with possible decarburization of parts. Decarburization can be minimized (in many instances, practically eliminated) by use of proper atmosphere. In some cases, hardening or carburizing may follow rather than precede brazing. The high melting temperature of copper makes subsequent heat treatment entirely feasible. In others, it may be better to use silver brazing by localized heating, especially induction heating, in which temperatures of 1350 to 1400 F or even lower are sufficient to produce a suitable bond without decarburizing or adverse effects on hardness.

★ ★ ★ ★

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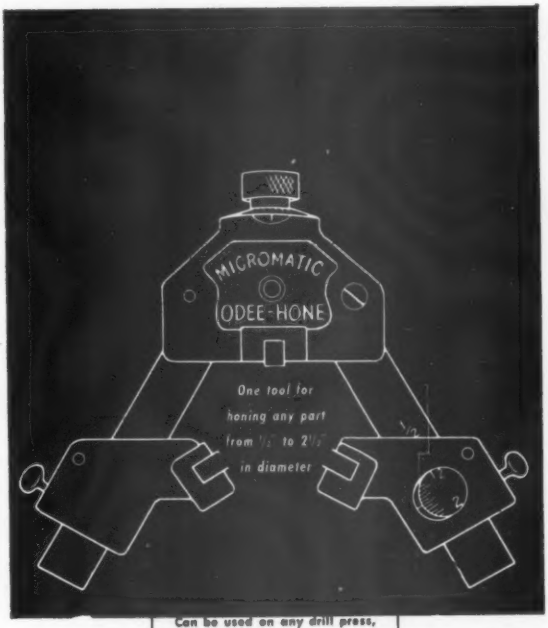


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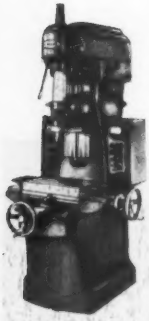

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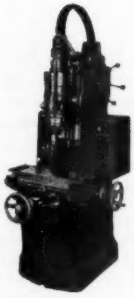

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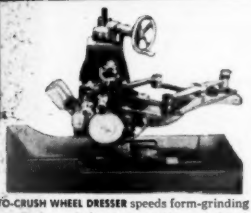

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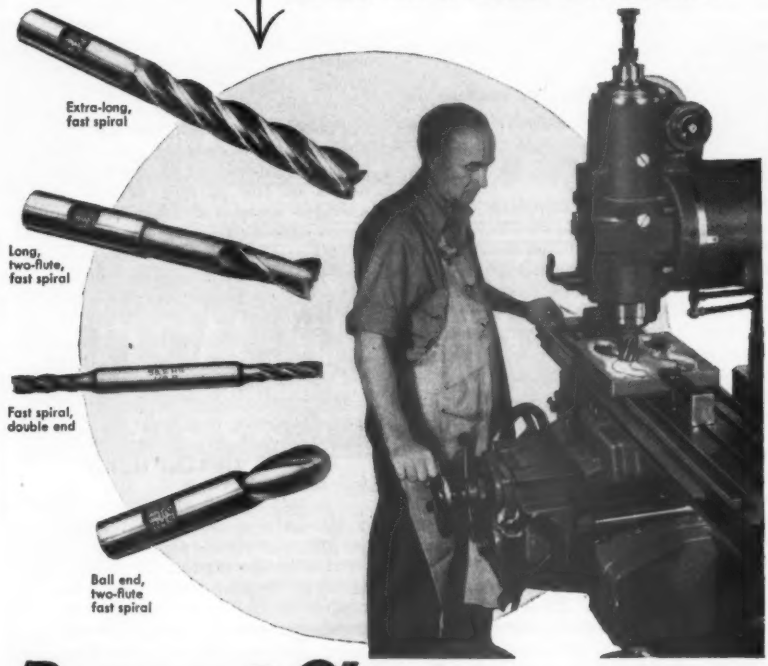


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. . . Thompson Training, from page 90

mated by the application of the method under consideration. However, the statistical universe of values produced by the changing manufacturing process resulting from the inter-action of the forces set in motion by the combined inter-action of man, material, and the machine is seldom known; consequently, comparison of the complete process with its statistical estimate based on limited sampling is practically impossible. But if faith in the routine quality control shop techniques is to be firmly established, such comparison is of tremendous importance; consequently, in our Thompson course, practically all training is based on data readily collected from the stable statistical universe represented by the resulting large distribution pattern of values from an electrically driven sampling machine constructed by the company.

### Purpose of Sampling Machine

The machine is of inestimable value as it facilitates the teaching of quality control principles either from the inductive or deductive viewpoint.

To illustrate, if the sampling machine, into the stock bin of which 500 steel balls are poured, is run ten times in succession and the distribution of each 500 balls into the 39 channels below the 21 rows of pins through which they must pass are recorded and then combined, a huge sample of 5,000 values, truly representative of the result of the stable system of chance causes operating in the machine, is quickly established.

For practical purposes, 5,000 values and their organized frequency distribution are viewed as the "known universe" or "standard" represented by the process set in motion by the run of the machine. Now if a series of small samples, let us say, of 5 values each, when processed through the control chart method yields a very close estimate of the pattern of variability of the same assumedly unknown universe, our faith in the method used for the prediction of that universe pattern is either established or greatly fortified.

In some classes the "universe" of the known pattern, from which the course proceeds, is constructed at the beginning of the course and from its composition the statistical behavior of averages and ranges of small subgroups of values is deduced on the basis of logical inference and is corroborated by statistical analysis. When the shop personnel is instructed, emphasis is placed on the truly unknown universe represented by the still unknown pattern of the sampling machine which is constructed piece by piece by combining a number of small samples of values from 2 to 15 values each.

### The Inductive Method

This inductive method is especially effective and profitable with shop people; it teaches them not to judge the unknown process variability by unrelated individual measurements, but rather to judge it on the basis of collective evidence embodied in the chart for averages and ranges properly analyzed and interpreted. In this inductive approach, the representative picture of the "infinite" universe is eventually presented by several complete runs of the machine, to test the reliability of the various estimates of the pattern of the unknown universe estimated from the scant evidence embodied in the samples.

This method offers an excellent opportunity to teach practical and economy-minded shop personnel what makes for the reliability of such values as Xr 6, ó′, etc. Because of the importance of such reliability in relation to the method and extent of sampling, much training in the application of tests for reliability and of similar statistical safeguards is given.

### Attributes Method

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(Continued on page 192)

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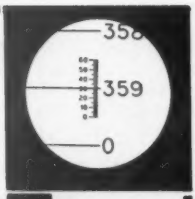


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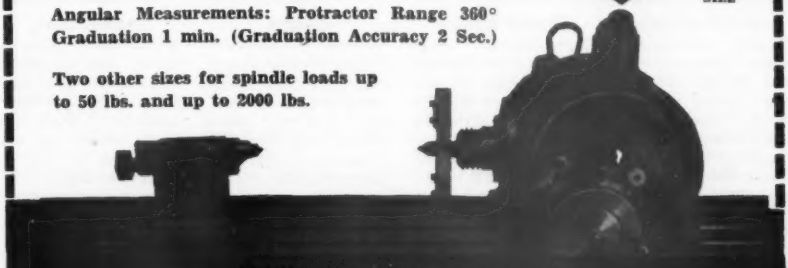

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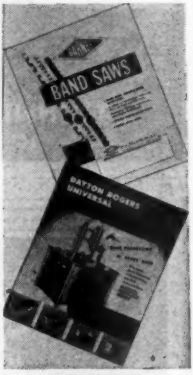


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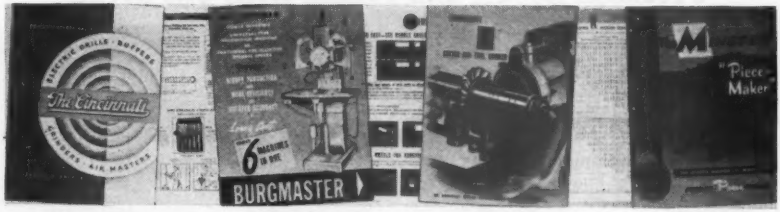


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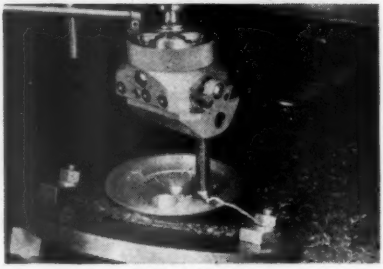

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tools. Tapers may be bored by using cross feed in conjunction with axial feed of machine spindle or table. The slides move in both directions, to the extent of half their adjustment beyond the central axis of the head. Thus, widest possible adjustment of tool slide is possible without destroying the balance of the head.

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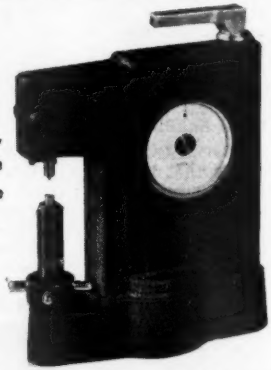

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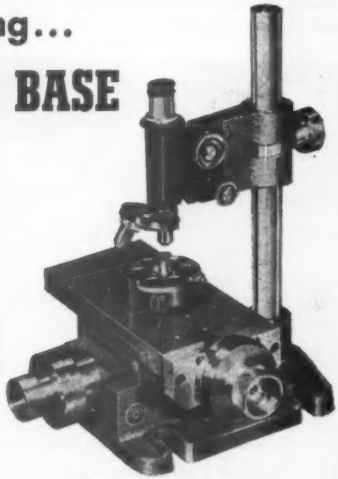

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# New Metal Treating Process Speeds Cold Working, Cold Extrusion of Steel

A new metal treating chemical process, which greatly extends lubrication limits in the cold working of steel, consists of compatible cleaning, pickling and application of a new phosphate coating and specially developed lubricants for steel. A heat-resistant lubricating surface is produced which is chemically interlocked with the steel and, therefore, possesses exceptional adherence even under the most severe working conditions.

It was to improve earlier German work in cold extrusion that the new phosphate coating chemical bath was developed by researchers of the Heintz Manufacturing Company of Philadelphia. Research has resulted in the evolution of the carefully integrated Foscoat metal preparation process.

The efficiency of the Foscoat Process has been sucessfully demonstrated in cold extrusion and therefore brings this fabricating technique one step nearer to general commercial use. The next step, according to Heintz engineers, awaits the general availability of press equipment of sufficient size and designed to take advantage of the raised lubrication limits.

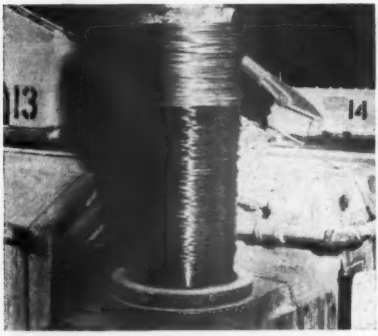


**Fig. 1. Surface finish obtained in a large wire mill, using Foscoat Process lubrication, as compared with former conventional lime practice. The uniform, dark colored, scratch-free surface is superior to the shiny, non-uniform scratched surface resulting from use of lime. Moreover, the Foscoated wire is drawn at speeds resulting in a 40 per cent increase in production rate. Despite this speed-up, die life has been increased 2½ times.**

Photos courtesy Pennsylvania Salt Mfg. Co.

**Fig. 2. Use of Foscoat Process in deep drawing stamping at Heintz Manufacturing Co. is shown by this two-step press operation in production of an automatic washing machine tub. Reduction in scrap loss and in down-time for stoning of dies has resulted in a 140 per cent increase in production rate.**

But of more immediate importance to industry are the remarkable results which have been attained in such applications as tube drawing, wire drawing, deep drawing (ironing), deep stamping, cold heading and similar cold working operations.

In these operations there generally exist two limitations—lubrication and the ductility of the metal. The former limitation is virtually eliminated by the chemically bonded lubrication film imparted to steel surfaces by the Foscoat Process.

Significant economies resulting from this improvement in lubrication include elimination of intermediate press operations, as well as annealing and chemical treating operations; additional reduced consumption of chemicals because of compatibility; increased production with existing equipment; savings in metal or reduction in scrap losses, and considerable extension in the life of costly dies.

In wet drawing of fine steel wire, Figure 1, commercial application of the Foscoat Process resulted in a 40 per cent increase in the rate of production—actually to the highest rate of capacity of the drawing equipment. Despite this

**(Continued on page 128)**

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# Two 2-Station Fixtures Speed Up Detent Job

The job shown at the top of the opposite page was broached on an improved duplex (double ram) vertical hydro-broach machine illustrated at the bottom with clamping fixtures installed.

The part is a detent or pawl made of forged steel and machined by contour broaching. Stock removal averages $\frac{3}{32}$" with each stroke of the ram and the production amounts to 98 pieces per hour completely broached.

The chief advantage offered by the improved design of this broaching machine is in the table construction. The rams operate alternately up and down, cutting on the down stroke. In front of each ram, an individual table advances to the cutting position and retracts to the loading position, synchronized with the movement of the rams.

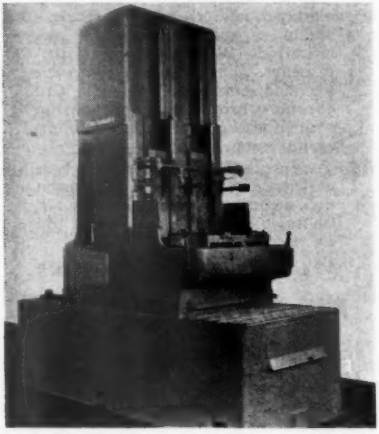
For machining this detent job, the machine was tooled up with fixtures and cutting tools (broach inserts) specially designed for the contours to be cut. Each fixture is a two-station hand clamping unit, holding one part in each station.

Starting from the left-hand side of the left-hand fixture, the parts progress to the right. Therefore, fixture station Nos. 1 and 2 are mounted on the left-hand table and Nos. 3 and 4 are on the right-hand table. The four broaching operations are indicated in the drawing where the stock removal is shown by the heavy lines. In this type of setup, one part is completed at the end of each cycle of the machine, a cycle being the descent of both rams operating alternately.

In starting a broaching run on this part, the operator clamps a forging in the No. 1 station and starts the machine. Upon completion of the press stroke, he removes the piece and places it in the No. 2 station and reloads the first station with a new forging. At the end of this cycle, he removes the work from the second station, moves the piece from the first station to the second, reloads the first station and, while the left-hand ram descends, he loads the third station with the part from the second station. For the next cycle the fixtures are all loaded and, as the cycle is completed, the part from the fourth station is completely broached. Thus, as the parts in the first and second stations are being broached by the left hand ram, the third and fourth stations are unloaded and reloaded, and as the parts in the third and fourth stations are broached by the right-hand ram, the first and second stations are being unloaded and loaded.

Quite naturally, a setup of this type requires considerable handling of the work and manipulation of the fixtures. For operating safety, the Preset Cycle Control feature (identified by the buttons mounted on extension brackets) automatically stops the ram cycles at the upper end of their traverse, unless the fixtures have been reloaded and the preset buttons touched before the return stroke has been completed. Thus, the cycle will operate continuously or stop at the end of each ram cycle, as desired by the operator.

**Fig. 1. The duplex vertical hydro-broach machine set up with fixtures to perform the broaching operations indicated by the drawing at the top of the opposite page.**



Photos courtesy Cincinnati Milling Machine Co.

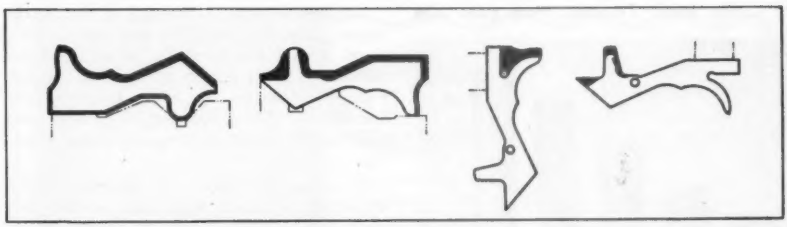
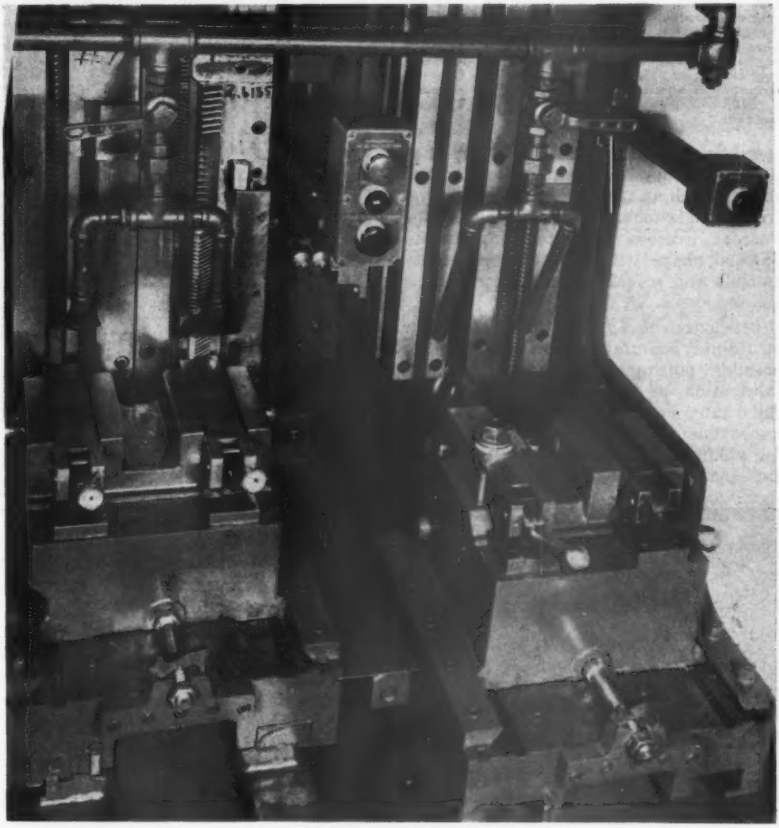


**Fig. 2, Above.** A forged detent contour-broached in four operations. The pieces progress from left to right and the metal removed at each station is indicated by the heavy lines.

**Fig. 3, Below.** A view of the two broaching tables on each of which is mounted a two-station clamping fixture. One table is positioned in front of each ram and advances to cutting position and retracts to loading position automatically. They are hydraulically actuated and synchronized with the movement of the ram.



. . . New Metal Treating, from page 124

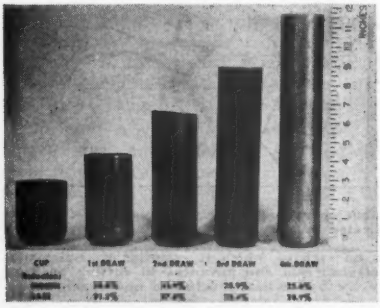


Fig. 3. Deep drawing (ironing) of a hollow cylindrical steel component using Foscoat Process lubrication. The four drawing operations were accomplished from the starting cup with no intermediate annealing and only a single application of the Foscoat Process. Over-all reduction is about 80 per cent, which represents a 100 per cent increase over conventional methods.

speed-up, die life was increased 2½ times. In dry drawing of steel wire shapes, such as triangle and square wire, from round stock, one application of the Foscoat Process permitted drawing to finished shape without the intermediate anneals and recoating required in previous processes.

Production use of the Foscoat Process at Heintz Manufacturing Co. has made possible substantial economies in the fabrication of automatic washing machine tubs, Figure 2. Reductions in scrap losses due to rejects and in down-time for stoning of dies have resulted in an increase of 140 per cent in output.

Fig. 4. Backward cold extrusion employed as the first step in forming a hollow cylindrical body. A steel billet is shown that has been treated in the Foscoat Process.

In deep drawing (ironing) of steel cartridge cases, Figure 3, 80 per cent reductions in wall thickness in the metal were possible with a single application of the Foscoat Process without intermediate annealing. This represents a 100 per cent improvement over conventional practice.

In actual production in rod-pulled tube drawing, over-all reduction of 80 per cent were achieved with a single application of the Foscoat Process, or about 60 per cent improvement over that previously obtained. In another tube mill, using plug drawing, over-all reductions of 60 per cent were obtained with one application of Foscoat, which is also a 60 per cent increase over existing practice.

Fig. 5. The cup is formed in a single press operation from the billet shown in Figure 4. Reduction is on the order of 50 per cent overall. Alternate method would probably be to hot forge or hot upset a billet of about twice the starting size, followed by extensive machining.

Even more dramatic savings are in prospect in commercial cold extrusion, Figures 4 and 5, for it can often eliminate the necessity for forging or upsetting of heated billets. These operations generally require a starting billet twice the size of that necessary for cold extrusion. The forged shape usually requires extensive scrap-generating machining.

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(Continued on page 144)

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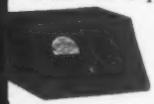

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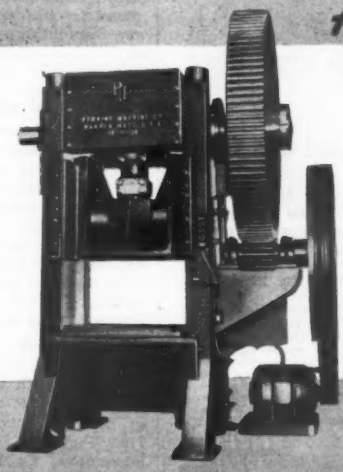

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# PUBLICATION

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**P&W Carbide Cylindrical Ring Gages** are the subject of Circular No. 519. They are made of solid carbide in sizes from .059" through 1.510" and eliminate the hazard of gage wear on close tolerance work. PRATT & WHITNEY, 15 Charter Oak Blvd., W. Hartford 1, Conn.
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**The Detroit Tensile Testing Machine** is described in a new catalog sheet. This machine is made in 10,000 and 20,000 lb. capacities for testing spot-welds, strip, wire, etc., This sheet can be had from DETROIT TESTING MACHINE CO., 9390 Grinnell Ave., Detroit 13, Mich.
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**Five New Sizes of Jig Feet and Rest Buttons** have been added to the Morton Machine line. They are all carburized, hardened and ground. These new sizes are being manufactured and carried in stock in order to provide the widest range of usefulness to tooling programs. Full size templates for tracing purposes are available from MORTON MACHINE WORKS, Dept. 21, 2421 Wolcott, Detroit 20, Mich.
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**Simplytrol Automatic Controls.** Bulletin SC-1 from Assembly Products, Inc., describes inexpensive contact meter-relays that are providing direct contact control in many processes where more complicated and expensive equipment was previously required. These contact meters will control any process that can be measured with an electric meter. The bulletin shows the circuits of three styles of controls using Simplytrol Contact Meters. ASSEMBLY PRODUCTS, INC., Dept. T&P, Main at Bell St., Chagrin Falls, Ohio.
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**The New Multi-Angle Drill Unit** designed to provide unlimited freedom of setup to simplify and reduce the cost of drilling holes at any angle, is announced in current Commander literature. Write for a copy to COMMANDER MFG. CO., 4225 W. Kinzie St., Chicago 24, Ill.
**Inform-A-Gram No. B22.**

**The Eriez Magnetic Conveyor Element** is featured in Bulletin No. 553. Several typical installations are described thoroughly. Types available, method of selection, and cost-cutting characteristics are listed. ERIEZ MFG. CO., Dept. T&P, Erie, Pa.
**Inform-A-Gram No. B23.**

**The Universal Drawn Shell Trimmer** of Dayton Rogers was especially designed to trim square or rectangular shells with small corner radii. A new, four-page folder illustrates shells that have been trimmed with this machine, contains plan views of the operating principle, and describes operating features. A full page is devoted to specifications and dimensions. DAYTON ROGERS MFG. CO., 2824 13th Ave. South, Minneapolis 7, Minn.
**Inform-A-Gram No. B24.**

**Cost-Cutting Pressroom Equipment** made by Whyte Engineering Co. is described in newly available liteature. This equipment includes roll feeds, stock cradles and stock straighteners.
**Inform-A-Gram No. B25.**

**Jig and Fixture Template Sheets.** The latest catalog of Jergens Tool Specialty Co. features 54 pages of full-scale template drawings of standard jig and fixture parts available from this Cleveland firm.
**Inform-A-Gram No. B26.**

GREATEST COST SAVER IN METAL CUTTING
Cutting Hard-Tempered 1/8" Chrome Moly Steel
Sawing 16" Steel Piling
FRICTION sawing with Tannewitz High Speed Band Saws results in perfectly amazing time savings in the cutting of flat sheets of soft or hardened steels, non-ferrous metals, armor plate, glass, plastics, many other materials and the trimming of castings. For cutting formed parts there's nothing to compare with it. The down-drag of the saw is so negligible that parts may be trimmed or sawn as desired without using a rest of any kind. Whatever your cutting requirements, chances are they can be handled faster and at less cost with Tannewitz High Speed Band Saws.
THE TANNEWITZ WORKS
GRAND RAPIDS, MICHIGAN
Write for Your Free Copy on Friction Sawing
FRICTION SAWING with Tannewitz HIGH SPEED BAND SAWS

SEE ADVERTISERS INDEX, PAGE 183, FOR KEY NUMBERS

**The Protectron Damage Control System,** described in a current Brinnell Co. bulletin, is especially useful in decreasing die breakage and increasing die life between grinds. This bulletin describes the operation of the Protectron system and contains several application photos.
**Inform-A-Gram No. B27.**

**All the Facts** on Brighton Nu-Process and Uni-Quality are contained in a detailed catalog from the manufacturer of B-Right-On Socket Screws.
**Inform-A-Gram No. B28.**

**A Novel Swiss Precision Machine** for cold rolling threads is fully described in an 8-page booklet available from Carl Hirschmann Co. The machine was developed by Thommen S. A., Waldenburg, Switzerland. Write to CARL HIRSCHMANN CO., 30 Park Ave., Manhasset, N. Y.
**Inform-A-Gram No. B29.**

**Tool and Cutter Grinders,** fixtures and attachments are pictured and described in K. O. Lee's attractive, 24-page catalog.
**Inform-A-Gram No. B30.**

**The E & G Compound Microscope Base** offers 6" lateral and 4" traverse continuous micrometer motion. This instrument does double duty as a versatile, accurate compound working table for machine operations on light, precision machine and instrument parts, and as a complete toolmakers' microscope. Illustrations, specifications, suggested optical units, applications, prices and other data are given in a new brochure. Send for a copy to ERB & GRAY, 854 S. Figueroa St., Los Angeles 17, Calif.
**Inform-A-Gram No. B31.**

**"Surface Evaluation by Faxfilm"** is the title of a new, eight-page folder describing applications and equipment for Faxfilm. Faxfilm is the process that employs a plastic replica to show roughness, wear, grain and other surface conditions of almost any shape of a wide variety of materials. THE BRUSH DEVELOPMENT CO., Instrument Div. 50, 3405 Perkins Ave., Cleveland 14, Ohio.
**Inform-A-Gram No. B32.**

**Designed to Speed Pattern, Die and Mold Finishing,** Haskins HS-4 Flexible Shaft Equipment assures quality production. New literature describes Haskins' complete line of machines and attachments for all grinding, sanding, filing and polishing operations.
**Inform-A-Gram No. B33.**

**The New Cartridge Type Packing Gland,** combining double bearing surface, low friction ram seal, and a ram wiper into a single compact unit, highlights Pemaco Hydraulic and Air Cylinders. Petch Mfg. Co. will provide complete information and engineering data.
**Inform-A-Gram No. B34.**

**Minster's Series P "Piece-Maker" Presses** are presented in attractive, 16-page Bulletin No. P251. These new automatic production presses are designed to meet the most rigid requirements for the accuracy of alignment needed to produce successfully intricate stampings with the finest of progressive dies. The bulletin illustrates all models in the series, lists their features and optional equipment, and gives complete specifications. THE MINSTER MACHINE CO., Dept. T&P, Minster, Ohio.
**Inform-A-Gram No. B35.**

**Concentric Spring Loaded Live Centers** are described in a new illustrated bulletin. These centers for precision turning and grinding have less overhang and consequently provide more rigidity and more working range. Other features, specifications and prices are given in the bulletin. CONCENTRIC TOOL CORP., 2970 Huntington Drive, San Marino, Calif.
**Inform-A-Gram No. B36.**

**Parlec Drill Jigs** provide the subject matter for a newly published folder. They are designed to save hours of valuable design and toolmaking time. The folder includes construction features, illustrations and prices. Write for it to the national sales agents, FRANKLIN E. SMITH & ASSOCIATES, 6201 Carmelita Ave., Bell, Calif.
**Inform-A-Gram No. B37.**

**South Bend Economy Model Drill Press** features and specifications are contained in Bulletin 5103. Also included are complete lists of drill press accessories and the company's distributors. SOUTH BEND LATHE WORKS, Dept. T&P, South Bend 22, Ind.
**Inform-A-Gram No. B38.**

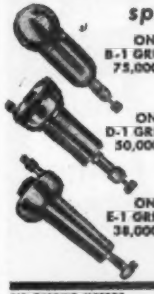
**Colorful S & E Bulletin 103** contains actual size and shape illustrations of tungsten carbide rotary cutters. Metallic blue coloring indicates the solid tungsten carbide. S & E MACHINE PRODUCTS INC., Dept. T&P, Bridgeport 4, Mich.
**Inform-A-Gram No. B39.**

**Littell Pres-Vac Safety Feeders** feed blanks from a distance of 14", eliminating the need for putting fingers under the press ram. The current Littell catalog provides complete details.
**Inform-A-Gram No. B40.**

**"Superbore" Counterbores** provide that shade of difference when counterboring operations require oversizes from standard dimension holes. Twentieth Century Mfg. Co. can supply price information and descriptive literature.
**Inform-A-Gram No. B41.**

**The New Famco Air Press Catalog** describes 20 rugged, compact models built for high-speed production operation. They are available in ½ to 3½ ton capacities with electric or air controls.
**Inform-A-Gram No. B42.**

THIS *Whirlwind* IN YOUR HAND
speeds grinding and deburring jobs!




Compressed air . . . and Onsrud's famous Air Turbine Grinders . . . give you an unbeatable combination for speedier grinding in the tool and die shop or on the production line.
Can be mounted on lathe for center or finish grinding. D1-S Hole Grinder supplied for mounting on jig borer, milling machine or drill press for precision hole grinding.
Light in weight. Always cool in operation. Free from vibration, yet packed with power. Write for Bulletin 1129.

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ROUTERS AND SHAPERS
CONTOUR MILLING MACHINES
HIGH CYCLE MOTORS

ONSRUD MACHINE WORKS, INC.
3941 Palmer Street • Chicago 47, Illinois


SEE ADVERTISERS INDEX, PAGE 183, FOR KEY NUMBERS

**"Comtorplug" Internal Comparator.** Illustrated Bulletin No. 40 gives complete construction features and instructions for use of this portable production and inspection gage. The instrument gages bores to fractions of .0001".
**Inform-A-Gram No. B43.**

**The Illinois Die Filing Machine** is an accurate, smoothly-operated machine that files, saws and stones the most intricate die shapes. An illustrated brochure contains complete information.
**Inform-A-Gram No. B44.**

**Micro Miniature End Mills** can perform such operations as milling, engraving, routing and profiling. A detailed catalog on these precision-ground-from-solid tools is procurable from Woodson Tool Co.
**Inform-A-Gram No. B45.**

**Type TD Twin Wheel Tool Grinder** is completely described in The Standard Electrical Tool Company's Bulletin 18. With this heavy duty machine, there is but one step from rough to finish grind.
**Inform-A-Gram No. B46.**

**The Advantages,** limitations and fields of application of Crobalt cast alloy cutting tools are discussed in new Bulletin 101. It describes the working conditions under which high speed steels, cemented carbides and cast alloy cutting tools each give best performance. Forms and sizes of Crobalt tools available for various turning, facing, milling and other operations are illustrated and described. Also included is a table of recommended speeds and feeds. CROBALT, INC., 2800 S. State St., Ann Arbor, Mich.
**Inform-A-Gram No. B47.**

**Solution to Difficult Quench Oil Purification Problems** at Salisbury Axle Works, Div. of Dana Corp., is discussed in a new, specially prepared case history published by Honan-Crane. Entitled "Oil Quenching." This bulletin contains photographs and schematic drawings. HONAN-CRANE CORP., 208 Indianapolis Ave., Lebanon, Ind.
**Inform-A-Gram No. B48.**

**An Adjustable Automatic Stock Feed Stop for Dies** is presented in a new pamphlet. The Dahlstrom Light Duty "Autostop" is adjustable to work with blanking, progressive and compound dies. It mounts on the stripper plate in 15 minutes, handles sheet steel up to 1/16" x 6" or equivalent.
**Inform-A-Gram No. B49.**

**"Superior" All-Steel Die Sets** feature the exclusive Lock-Jaw Lifting Device and E-Z Lift Sling Chain that makes it possible to move these die sets for any distance, in any direction. Details are included in Bulletin No. 850 of Superior Steel Products Corp.
**Inform-A-Gram No. B50.**

**Silicon-Free, Flux-Coated Aluminum Welding Rods** for oxy-acetylene and oxy-hydrogen welding have been released by Eutectic Welding Alloys Corp. New EutecRod 22FC provides a base metal matching solution for many applications where anodized silicon bearing welding rod has always shown an objectional dark weld. The reason for this is that corrosion resistance and color, as well as physical properties of the weld, closely match the aluminum. Full details and specifications can be had from EUTECTIC WELDING ALLOYS CORP., Dept. TIS, 172nd St. & Northern Blvd., Flushing, N. Y.
**Inform-A-Gram No. B51.**

**Elgin's New Diamond Abrasive,** which has been prepared especially for lapping and polishing carbide drawing and heading dies, is presented in a four-page folder. Designated DYMO-C (C for carbide), this new abrasive is said to finish carbide dies up to 20% faster than abrasives formerly used. The folder details its specific performance and application advantages, contains complete catalog and price data. ELGIN NATIONAL WATCH CO., Abrasives Div., Dept. T&P. Elgin, Ill.
**Inform-A-Gram No. B52.**

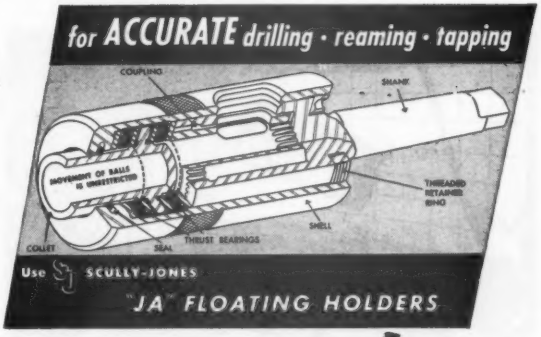
**Photos and Captions** in a new bulletin illustrate the various uses to which Colonial Broach Company's improved "Utility" presses can be put effectively. Four-page Bulletin VBS-51 gives the working capacities of these 4 to 10 ton machines and also includes a plan drawing that shows all installation dimensions. COLONIAL BROACH CO., Box 37, Harper Station, Detroit 13, Mich.
**Inform-A-Gram No. B53.**

**A 24-Page Catalog** contains complete design specifications of the No. 2 Moore Jig Borer, describes jig borer accessories and gives many examples of jig borer jobs in the toolroom and on the production line.
**Inform-A-Gram No. B54.**

**Dumore Tool-Post Grinders** can be set up in minutes, grind to .0001" and have unlimited uses in any shop. A descriptive bulletin is offered by the Racine manufacturer.
**Inform-A-Gram No. B55.**

**Hovis Universal Washer Dies** provide a master holder and by merely changing five small, easily removable parts the new washer or blank is produced. Hovis Screwlock Corp. will honor requests for literature.
**Inform-A-Gram No. B56.**

**"Step Up Production"** is Minnesota Mining & Mfg. Company's new 36-page booklet that shows how belt grinding cuts costs. This publication is packed with excellent illustrations.
**Inform-A-Gram No. B57.**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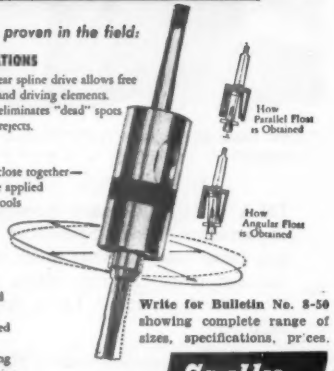
**UNIFORM CUTTING OPERATIONS**
Clearance in the double-gear spline drive allows free movement of the floating and driving elements. This prevents binding and eliminates "dead" spots or zones which often cause rejects.

**CONTINUOUS PRODUCTION**
Two thrust bearings—placed close together—minimize the effect of the force applied on the tool by the hole. Thus, tools float freely into alignment—reducing down time and damage to cutting tools.

**TROUBLE-FREE OPERATION**
Balls are free to move in the required direction or rotate around the collet, because the floating element is separated from the drive. Free movement of the balls eliminates confined reciprocating motion. This greatly reduces the scrubbing action characteristic of small rocking movements. The scrubbing action often causes rapid destruction of ball-thrust plates and prevents free float.




**Write for Bulletin No. 8-50** showing complete range of sizes, specifications, prices.

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**R-B Punches, Dies, Retainers** and other diemaking parts are fully covered in Allied Products Corporation's attractive, 52-page catalog. These punches and dies are stocked in standard sizes, shapes and materials for immediate delivery.
**Inform-A-Gram No. B58.**

**Durant Friction Type Roll Feeds** are pictured and described in a four-page folder issued by the Providence, R. I., manufacturer. Features and specifications of seven models are listed.
**Inform-A-Gram No. B59.**

**A Colorful, New, 40-Page Catalog.** Cincinnati Milling Machine Company's Publication No. M-1734, pictorially shows the reader just about everything the No. 2 Cutter and Tool Grinder can do. Contents include front and rear views, applications, features, attachments, grinding wheels, specifications, standard equipment, and accessories and attachments. Write for this attractive catalog to THE CINCINNATI MILLING MACHINE CO., Dept., T&P, Cincinnati 9, Ohio.
**Inform-A-Gram No. B60.**

"LOOK HOW RUDOLPH'S OUTPUT HAS INCREASED SINCE THEY CHANGED TO THE RIGHT CUTTING FLUID!"

**IN A TEST on Gleason Revacycles in a large gear department Stuart's SpeedKut "A" increased output from 1200 to 3200 gears per tool grind and reduced stock removal, when regrinding cutters, from .009" to .0035". Let a Stuart Representative help you.**

***Are you receiving Stuart's SHOP NOTEBOOK regularly? Write, wire or phone.***

D.A. Stuart Oil Co.

2729-37 South Troy Street, Chicago 23, Illinois


**A 12-Page, Precision Reamer Catalog** is offered by The DoALL Co. Excellent illustrations at the top of each page are followed by detailed listings giving technical data and prices on chucking, expansion, shell, taper pin and stub screw machine reamers. Of considerable interest are items not usually cataloged as standard, such as the new diemakers' reamers with tapers of .006" per inch, letter and number size reamers and decimal size chucking reamers. Send for Catalog No. 51-814 to THE DoALL CO., Dept. T&P, 254 N. Laurel Ave., Des Plaines, Ill.
**Inform-A-Gram No. B61.**

**A New Concept** in the field of small electric furnaces for heat treating metals is offered in the Series 7055 Lucifer Furnaces. A new catalog sheet contains a complete description of these furnaces, together with prices, users, etc. GILBERT S. SIMONSKI CO., Easton Pike, Neshaminy, Pa.
**Inform-A-Gram No. B62.**

**The Dillon Multi-Low-Range Universal Tester** is the subject of a current bulletin. The tester operates by means of a calibrated pendulum—a very accurate load measuring device. Outstanding features are described and pictured. W. C. DILLON & CO., INC., 1421 S. Circle Ave., Forest Park, Ill.
**Inform-A-Gram No. B63.**

**Kipp Featherweight Air Grinders** are presented in current Madison-Kipp Catalog AT 3006. Besides covering these cost-cutting grinders, the colorful, 20-page catalog also illustrates and describes various accessories. These include mounted grinding wheels, Kipp Cutters, tool post adapters, etc.
**Inform-A-Gram No. B64.**

**Twenty-Eight Different Models of Air Cylinders,** each in nine bore diameters, are illustrated and described in Rivett's new Catalog Section No. 55. This 8½" x 11", three-color book lists every standard air cylinder offered in the industry. Working drawings and specifications are furnished for each model and size cylinder. Information relative to a particular model is all shown on one page, facilitating easier layout of circuits by the engineer. RIVETT LATHE & GRINDER, INC., Dept. T&P, Brighton 35, Boston, Mass.
**Inform-A-Gram No. B65.**

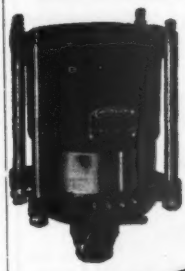
**Eutectic "Instant-Hardner"** for emergency surface hardening with an ordinary welding torch is described in an illustrated, six-page folder. This new product hardens steel tools, parts, dies, edges, etc., "in a jiffy" without the fuss and mess of conventional heat treating. Application photos, drawings and candid "how-to-do-it" outlines are contained in the folder. EUTECTIC WELDING ALLOYS CORP., Dept. 512P, 172nd St. & Northern Blvd., Flushing, N. Y.
**Inform-A-Gram No. B66.**

**Actual Quench Oil Purification Problems** and their solutions are discussed in a new Honan-Crane bulletin. This publication explains how installation of Honan-Crane oil purification equipment has prolonged useful life of the oil, greatly extended periods between cleaning operations, and substantially reduced equipment downtime. HONAN-CRANE CORP., 208 Indianapolis Ave., Lebanon, Ind., will promptly honor all requests.
**Inform-A-Gram No. B67.**

**Metron's New Series 42R Tachometer Indicators** are covered in technical data sheets now available from the manufacturer. These multiple head, single range, fixed type indicators can be used for monitoring speeds of many remotely located machines from one convenient location. Features, applications, installation and servicing are discussed. METRON INSTRUMENT CO., 432 Lincoln St., Denver 9, Colo.
**Inform-A-Gram No. B68.**

**The Burgess Vibro-Graver** writes like a pencil on steel, lead, glass, wood and other hard surfaces. This new, speedy, permanent marking tool engraves numbers or names on tools, jigs, dies, gears, finished parts. Descriptive liteature can be had from Burgess Vibrocrafters, Inc.
**Inform-A-Gram No. B69.**

**Allen Keys** are now torque-resistant without brittleness. Close tolerance of the hex form and sharp key corners assure accurate fit and top gripping ability. Literature is available.
**Inform-A-Gram No. B70.**



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For DEEP DRAWING
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KNOCK OUTS

Complete Die Cushion Engineering service at your disposal without obligation on all cushion applications.

DAYTON ROGERS
Manufacturing Company
MINNEAPOLIS 7, MINNESOTA

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**"Precision Grinding by Reid"** is a three-color folder featuring Reid Model 618 Precision Surface Grinder. Variable table speeds of 12 to 35 fpm are a highlight of this machine.
**Inform-A-Gram No. B71.**

**"Die-Co" Die Springs** are specially designed for greater travel, pressure and endurance. The Die Supply Co. is distributing Spring Bulletin No. 403 covering nearly 500 stock sizes.
**Inform-A-Gram No. B72.**

**"ElectroShield, the New Copper Clad Metal,"** is the title of a new American Cladmetals booklet. This informative publication shows how to stretch scarce copper supplies up to four times by the use of ElectroShield. The new metal saves up to 80% of copper. It can be used for most applications where copper sheets are now employed, and more. AMERICAN CLADMETALS CO., Dept. T&P, Carnegie, Pa.
**Inform-A-Gram No. B73.**

**Wohlhaupter Universal Facing and Boring Heads,** with self-acting power feeds and automatic end release, provide the subject matter for a new brochure. These German-made heads permit many operations to be performed at one setting. The brochure illustrates features of the four available models and lists all pertinent technical data. Write to the American distributor, KARL A. NEISE, 381 Fourth Ave., New York 16, N. Y.
**Inform-A-Gram No. B74.**

**An 8½" x 5½" Chart,** just printed, shows the applications, calibration symbols, conductors, polarity and Thermo Electric Instrument Society of America and Military color codes of thermocouple and extension wires. Resistance tables for these wires are shown on the reverse side. THERMO ELECTRIC CO., INC., Dept. T&P, Fair Lawn, N. J.
**Inform-A-Gram No. B75.**

**The New AccrAngle Grinder Attachment** allows grinding of cutting tools, threading tools, box tools or any single-point tool, any angle of rake or clearance, without removing from tool holder. This holder is adaptable to any surface or cutter grinder, holds tools up to ½". A catalog is obtainable from Carl Nomann Co.
**Inform-A-Gram No. B76.**

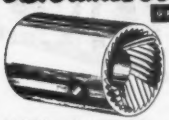
**The Complete Setup Procedure** for Producto's new positive action automatic feed, known as the "Sure-feed," is outlined in a new bulletin. Outstanding features of this simply designed, ruggedly constructed feed are listed. THE PRODUCTO MACHINE CO., 970 Housatonic Ave., Bridgeport 1, Conn.
**Inform-A-Gram No. B77.**


**Severance DEBURRING CUTTERS** HIGH SPEED CARBIDE

Unexcelled for power and hand deburring
Sectional pattern tooth give shearing action

**Severance INSIDE DEBURRING CUTTERS**
GROUND from the solid
Select 45° High Speed cutters from 28 standard sizes and 30° cutters from 35 sizes—from ¼" to 3" diameters.
Both angles can be supplied in CARBIDE

**Severance OUTSIDE DEBURRING CUTTERS**
GROUND from the solid



For speedy light deburring of rod ends and tubing O. D's., either off-hand or in screw machines. Select 30° cutters from 14 standard sizes and 45° cutters from 10 sizes—up to 4 inch diameter.
ANGLES 30° & 45° C/L
Both angles can be supplied in CARBIDE

**OUTSIDE CHAMFERING MILLS**

Operate in machines to perform heavy chamfering without chatter —in above size range and angles.

HEADQUARTERS FOR DEBURRING AND CHAMFERING TOOLS DEVOID OF CHATTER

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"A Twist of the wrist" easily bites off the burr left by drill or punch.
Ten standard sizes for ¼ to 2" diameters.
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SOLID (For Radius Up)

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BALL SEAT REAMER

**The Use of Sub-Zero Chilling for Shrink Fit** is fully described in new literature from Sub-Zero Products Mfg. Div. Utilizing the predictable shrinkage of metals chilled to 120° below zero F, the Sub-Zero process not only boosts production, but also eliminates rejects formerly associated with many press-fit assembly operations. This literature lists specifications of the new Model R-120 Chilling Machine. SUB-ZERO PRODUCTS MFG. DIV., DEEP-FREEZE DISTRIBUTING CORP., 3928 Reading Rd., Cincinnati 28, Ohio.
**Inform-A-Gram No. B78.**

**Magnetic Testing Data Sheet 2005** from J. W. Dice Co. covers typical uses, advantages and principle of operation of the Model C Cyclograph and the new automatic sorter combination. This equipment affords high speed, non-destructive analysis and sorting of metal parts in production or of finished parts. J. W. DICE CO., 1 Engle St., Englewood, N. J.
**Inform-A-Gram No. B79.**

**New Kling Punch Bulletin No. 712** contains complete punch and shear capacity charts, specifications and details to give you all the information you need to select the right Kling Punch to meet your specific punching requirements. Construction details are described in this illustrated booklet. KLING BROS. ENGINEERING WORKS, 1320 N. Kostner St., Chicago 51, Ill.
**Inform-A-Gram No. B80.**

**A Tool Steel Stock List** that is clear, concise and dependable is now available from Allegheny Ludlum. This 72-page catalog lists the stocks of 18 A-L warehouses.
**Inform-A-Gram No. B81.**

**Model 7-A Production Hobbing Machine,** described in a brand-new circular from Lees-Bradner, combines rugged sturdiness and extreme ease with which hobs can be changed and diameters can be controlled. The illustrated, 8-page booklet fully covers the outstanding features of this machine and lists specifications. Write for Circular No. 84 to THE LEES-BRADNER CO., 12100 Elmwood Ave., Cleveland 11, Ohio.
**Inform-A-Gram No. B82.**

**Dickerman Automatic Punch Press Feeds** will enable you to handle very large volumes of production in your press room without any increase in floor space. An up-to-date catalog describes seven models that mount on any die or press.
**Inform-A-Gram No. B83.**

**Atlantic Band Saw Blades** meet all the requirements for superior blades on complicated die and fixture radius cutting. The new Atlantic catalog is ready for distribution.
**Inform-A-Gram No. B84.**


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*at low cost*

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**High Speed and Carbide Service**

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SOLID CARBIDE DRILLS, developed by RAYMAC . . . cut, do not burn thru hardened metals at slower speeds . . . give cleaner and more accurate holes . . . less drill breakage and longer drill point life.

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PUNCHING and FORMING DIES
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**Inform-A-Gram No. B85.**

**Useful Information on Webber Micro Accurate Gage Blocks** is given in a highly illustrated 32-page booklet. Proper care of blocks is fully discussed, and detailed catalog information is presented on standard gage blocks, metric blocks, carbide blocks, heavy-duty blocks, angle blocks, and fixtures and accessories. WEBBER GAGE CO., 12903 Triskett Rd., Cleveland 11, Ohio.
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**Positioning and Transfer of Dies** are among the many uses of Hamilton Tool's Portelvator. Another pressroom application is the use of a Portelvator in fixed position for sheet feeding operations. Details on special applications of the Portelvator are obtainable from The Hamilton Tool Co., which also offers its Bulletin P-502 on standard Portelvators.
**Inform-A-Gram No. B87.**

**The Magna-Vise** holds any metal or rigid nonmagnetic material firmly in place on your present magnetic chuck. It permits you to take advantage of magnetic chucking for brass, aluminum, copper, etc. Hanchett Magna-Lock Corp. is mailing detailed literature.
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**Gorham "M-40-U" Alloy Centers** are introduced in Folder No. B-75. "M-40-U," a wear- and abrasion-resistant material, forms a core that is induction brazed into the steel shank of the center, after which the entire center is finish ground. Thus, the wear material is always supported by the tough shank steel throughout the life of the center. These centers require only a cleanup grind when wear finally occurs. The folder gives descriptions, dimensions and prices. GORHAM TOOL CO., 14400 Woodrow Wilson Ave., Detroit 3, Mich.
**Inform-A-Gram No. B89.**

**The Boeckeler Model No. 2 Optical Micrometer** offers excellent range, capacity and accuracy, according to a newly-published circular. Specifications, prices and illustrations are included in the circular. Write for a copy to BOECKELER INSTRUMENT CO., 31 E. Rillito St., Tucson, Ariz.
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. . . New Metal Treating, from page 128

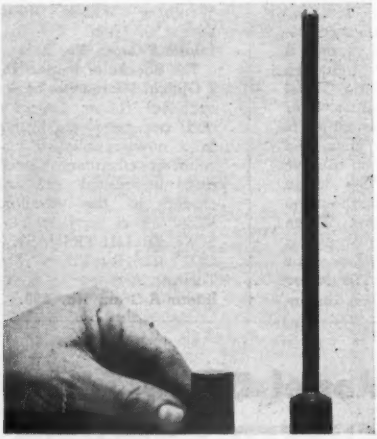

**Fig. 6. Typical example of forward cold extrusion. The starting billet, shown at left, is transformed to the elongated form with a single press operation. Reduction in cross-sectional area is about 85 per cent, which is not the limit of reduction possible.**

plain carbon steel for applications ordinarily requiring steels containing critical and expensive alloying materials. Cold extrusion involves the concept of steel as a plastic material which, when the barriers of friction are sufficiently extended, will flow under pressure. Stressing the steel in compression—in contrast to cold drawing where forming is performed by stressing the metal in tension—permits a drastic kneading action that increases strength characteristics considerably, with but slight effect on ductility.

Cold extrusion, Figure 6, made possible by improvements and modifications to phosphate coating techniques, was developed and used in Germany during World War II, principally as a steel-saving device, to produce cartridge cases, other ammunition components, gun barrels, airplane parts and other tubular or cylindrical bodies.

Immediately after the war, realizing its potential value to America, Heintz engineers studied German methods, correlated data and, with the aid of German technicians, carried out several research contracts for the United States Government. This preliminary work forms the basis for cold extrusion developments in the United States.

Subsequently Heintz technicians developed the new phosphate coating and lubricant around which the Foscoat Process has been built.

It was in this research and development that the present Foscoat Process was evolved. Foscoat itself is a specially formulated phosphate coating which can be applied by immersion, flooding or spraying, and forms a strong, adherent coating chemically bonded to the steel. This highly absorbent coating functions as a host for Foslube, an organic lubricant which is designed to react chemically with the Foscoat, in addition to being physically adsorbed and absorbed. The combined action gives a heat-resistant surface interlocked with the metal and which has exceptional adherence even under the most severe working conditions

In view of the importance of proper pre-cleaning and preparation for cold working, the complete process was worked out to include pickling and special alkaline cleaners, designated as Fosclean products.

While the process already is being used in regular operation in various cold working plants, the objective will be to extend it to other cold working operations where it may be applicable. The process has been successfully employed in conjunction with all grades of plain carbon and SAE alloy steels as well as some medium alloy grades. It is not intended, in its present state of development, for use with stainless and other high alloy steels.

Meanwhile, both in cooperation with the government and in private industry large scale production experiments and actual production in the field of cold extrusion are being carried forward using the Foscoat Process. In this connection, technical data are being supplied to machinery manufacturers and die designers.

Simultaneously, researchers of other cooperating companies are participating in research and development of further applications, which include the use of the Fos Products as a paint bond, and in rust-proofing and other types of metal coating.

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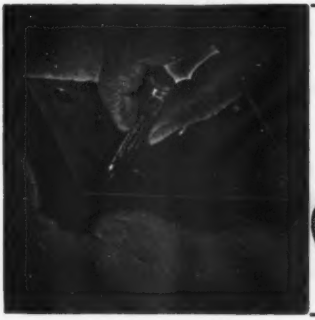

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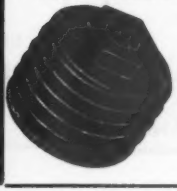

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SEE ADVERTISERS INDEX, PAGE 183, FOR KEY NUMBERS

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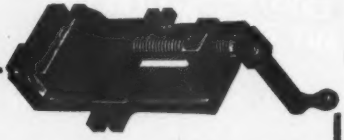

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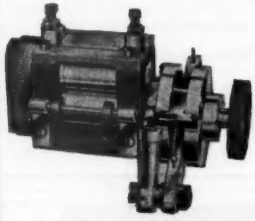

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## Who's Who at Metallurgical Congress

Top U. S. metal scientists have been named by the American Society for Metals to head the important technical discussions of international metal problems at the World Metallurgical Congress in Detroit, Oct. 14-19.

According to William H. Eisenman, executive secretary of the Society, the scientists selected to lead the meetings represent a top echelon "blue book of American metal experts."

The discussion leaders named include:

Dr. Francis C. Frary, director of research for the Aluminum Company of America, leading the sessions devoted to refining and processing of nonferrous metals; Dr. Erle G. Hill, director of metallurgy and development for the Wheeling Steel Corporation, conducting sessions devoted primarily to refining of ores and mixing of steel alloys; Dr. Gilbert Doan, head of the Department of Metallurgy at Lehigh University, leading the discussions concerning education and advanced training of metallurgists; Dr. Harold K. Work, director of research and development for the Jones & Laughlin Steel Corporation, conducting the sessions devoted to metal theory and research laboratories.

Dr. Carl E. Swartz, chief of metals research for the Armour Research Foundation of the Illinois Institute of Technology, leading the sessions on smelting of nonferrous metals; Dr. W. E. Thomas, vice president of the Magnaflux Corporation, who will chair the sessions devoted to recent advances in testing and inspection of alloy steels and metals; Dr. E. H. Stilwill, chief contact metallurgist, Dodge plant in Detroit, who has not yet been assigned but probably will conduct sessions on inter-industry material supply; and Dr. Gordon Johnson, supervisor of foundry research for the Armour Research Foundation, who is also unassigned as yet but will conduct sessions relating to new methods of metal casting.

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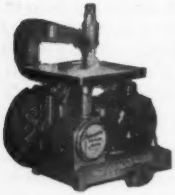

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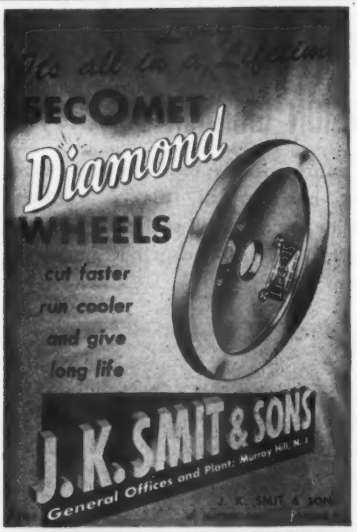


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## World-Wide Conservation of Scarce Metals

A World Committee on Metal Substitutes "to better coordinate American and Marshall Plan efforts to conserve scarce metals strategic to defense" has been called for by Walter E. Jominy, president of the American Society of Metals and chairman of the U. S. Government's Panel on Conservation of Alloys in Engineering Steels.

The official said an international counterpart to the American Panel should be drafted in recommendations at the World Metallurgical Congress in Detroit this month and submitted to Marshall Plan nations by their representatives attending the Detroit meeting.

"Metal substitutes for nickel, chromium and other alloy components offer the newest and best hope for sustained mobilization production of steel," Mr. Jominy declared.

He said that recent American experiments with boron steel, reviewed by his Panel, show that "metal scientists can cut drastically the amounts of alloy content in high grade steels."

"One ounce of boron added to one ton of steel cuts other less available ingredients nearly in half, and so far we have just scratched the surface in substitutes," he declared.

Mr. Jominy cited "honest differences" among metal experts of different nations on the question of substitutions. He said these will be aired at the Detroit meeting.

Mr. Jominy disclosed that re-worked metals so far include nickel, chromium, tungsten, cobalt, columbium and titanium.

The Detroit meeting, sponsored by the American Society for Metals, will be the first organized exchange of information on substitutions, according to Mr. Jominy. "On the basis of these sessions I think we may find present alloy formulaes outdated and wasteful. A more permanent organization to coordinate top research information on substitutes should result immediately out of the Congress," he stated.


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# MILITARY AND INDUSTRIAL PRODUCTION NEWS

**Contractor Security.** A revised military security clause for contractors has been inserted in the Armed Services Procurement Regulation by the Munitions Board. It changes the existing contract clause principally by deleting material which constituted a short security directive. It substitutes as a part of the clause the full, current Department of Defense Industrial Security Manual for Safeguarding Classified Matter. Under the revised clause, the government will notify the contractor of the degree of security to be furnished, the contractor will apply the Defense Department security manual, and the government will inspect occasionally to insure compliance.

**Plans to Provide Increased Facilities** for the manufacture of silicon carbide grain have been announced by Norton Co. Norton sells this silicon carbide grain under the trade name "Crystolon." Basically, the plans call for a re-equipping of two of the present abrasive mills in the Worcester, Mass., plant. By combining the crushing and milling units now housed in these two mills, the company's processing of silicon carbide grain will be increased 30%. The new unit will be known as Abrasive 7. Conversion work is now under way with full production in the re-equipped area expected late this year. Initial cost of the project is estimated at $750,000.

**Defense Expenditures.** $4.9 billion was obligated for the procurement of major equipment, supplies, military construction and expansion of production facilities by the Department of Defense during the month of July, 1951. Of this total, $4.4 billion was obligated for hard goods, $400 million for soft goods and $100 million for construction. This brings total obligations for the 13-month period following the attack on Korea to $40.2 billion for procurement and construction.

**"Converting to Military Production"** is a four-page pamphlet issued by the National Production Authority. It is specially designed to assist the small civilian producers threatened by materials shortages. It lists the steps and considerations involved in securing government contracts. Copies are available through Printing Services, Department of Commerce, Washington 25, D. C.

**A Two-Way Radio System,** believed to be the first in the country to be used exclusively for plant protection, will be installed at the Schenectady, N. Y., Works of the General Electric Co., according to an announcement by Charles H. Muir, Jr., Schenectady Works security agent. The network will include 35 base stations in guard posts throughout the 600-acre Schenectady Works and seven mobile stations installed in plant police cars, fire trucks and ambulances.

The construction permit was granted recently by the Federal Communications Commission. Previous to this ruling, the FCC had granted such independent two-way radio systems only to government organizations in connection with police and fire protection, and to forestry conservation units.

**A Booklet on Clearances to Handle Defense Contracts** has been issued by the Munitions Board's Office of Industrial Security. Entitled "How to Be Cleared for Handling Classified Information Within Industry," it is intended as an aid to businessmen seeking defense contracts. The booklet can be obtained, at 10 cents per copy, from the Superintendent of Documents, Government Printing Office, Washington 25, D. C.

**Prime Contractors Exhibit.** Companies in Michigan and surrounding states interested in obtaining defense subcontracts have been invited to send representatives to a Prime Contractors Exhibit for prospective subcontractors, to be held October 30 through November 2 in the Agricultural Building, Michigan State Fair Grounds, Detroit.

Purpose of the Exhibit is to assist small businessmen in contacting prime contractors who have work to farm out. Numerous displays of parts and equipment for which subcontractors are needed will be presented. Most of the exhibits will represent the hard metals industries, but the fields of electronics, plastics, packaging and others are also expected to be represented.

**New Magnesium Rolling Mill.** Equipment has been purchased and contracts awarded for the first building of a new Brooks and Perkins plant in the northwest suburban area of Detroit. It will be a modern, efficient, jobbing-type mill to roll magnesium sheet from slabs. The initial installation will include a hot mill and two cold mills with the necessary drives, ovens and auxiliary equipment. This new mill, where rolling operations will start in January, 1952, is expected to eliminate many of the delays now being caused by the short-supply of magnesium sheet.

**The 1951 Convention** of the National Tool & Die Manufacturers Association will be held November 1-4 in St. Louis, Mo.

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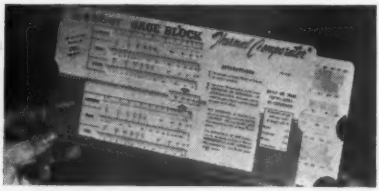
SEE ADVERTISERS INDEX, PAGE 183, FOR KEY NUMBERS

*Circle postage-free Inform-A-Gram Key Number for your request.*

**The Webber Thermal Comparator** measures the expansion of dissimilar metals and gives instant reading of the difference between gage blocks and the workpiece at various shop temperatures. Thus, the exact size the part




should be made can be quickly determined. The upper half is for use with steel blocks; the lower, with carbide. This slide rule comparator is now included with all Webber Carbide Gage Block Sets and is available separately at $1.00 each from THE WEBBER GAGE CO., 12903 Triskett Rd., Cleveland 11, Ohio.

**A Unique New Reference Handbook** for the entire drill bushing industry has just been released as an industry service by Ace Drill Bushing Co. Of special interest are the copyrighted comparison tables. These provide instant cross reference to some 3023 symbols used by other leading manufacturers. These tables compare their many symbols to actual A.S.A. Standard sizes and specifications as used by Ace. The handbook also serves as an Ace catalog. Write to ACE DRILL BUSHING CO., 5401 Fountain Ave., Los Angeles 29, Calif.

**Circle Inform-A-Gram No. C1.**

**"How to Use Parker-Kalon Self-tapping Screws"** is a 24-page, pocket-size booklet prepared to assist you in determining what screw or hole size to use. Detailed hole size recommendations are given and much useful application information is included in this illustrated publication. The recommendations will be found suitable for most applications. For your copy of this booklet, address PARKER-KALON CORP., 200 Varick St., New York 14, N. Y.

**Circle Inform-A-Gram No. C2.**

**"Recommended Standard Practice Manual for Machined Parts"** is a new, 18-page, illustrated publication of Quality Control Co. It is intended to aid in interpretation of drawings and it establishes tolerances unless otherwise specified from an inspection standpoint. It covers allowable eccentricity, taper, out-of-roundess, drafting definitions, etc. QUALITY CONTROL CO., 6356 Hollywood Blvd., Los Angeles 28, Calif.

**Circle Inform-A-Gram No. C3.**

**"How to Clean Metals in Aircraft Production"** is a comprehensive, 48-page Oakite booklet recently released. Detailed text and many excellent illustrations cover job-proved data on methods and equipment, as well as Oakite materials. An index of subjects and a products index are included. Address OAKITE PRODUCTS, INC., Dept. T&P, 22 Thames St., New York 6, N. Y.

**Circle Inform-A-Gram No. C4.**

**Twist Drill Data** of an informative nature is a feature of DoALL's new Catalog No. 51-816. Included are various charts on decimal equivalents of drill sizes, drill feeds and speeds, and tips on drill pointings and web thinning. Standard catalog information is given on taper shank drills, the various types of straight shanks, three- and four-fluted drills and drill sets, in addition to chatter-free

countersinks, masonry drills, etc., Write to THE DoALL CO., Dept. T&P, 254 N. Laurel Ave., Des Plaines, Ill.

**Circle Inform-A-Gram No. C5.**

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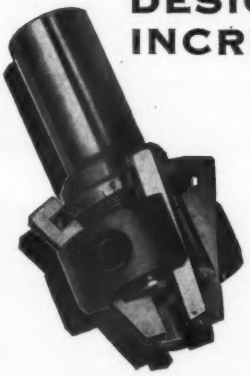

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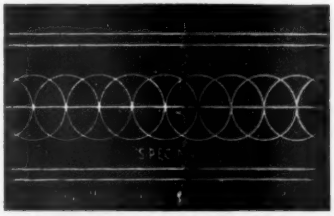

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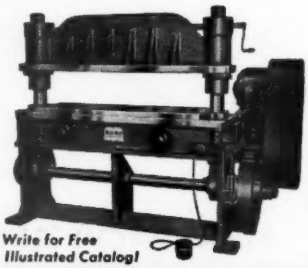

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**Circle Inform-A-Gram No. C6.**

**"What's Your Grinding Problem?** Here is a Norton trouble shooting manual for the grinding machine operator. There are over 20 pages of practical information especially helpful to new grinding hands. NORTON CO., 1 New Bond St., Worcester 6, Mass., will honor all requests.

**Circle Inform-A-Gram No. C7.**

**A Productive Maintenance Kit**—a file-size package of aids to guide the maintenance engineer in setting-up a working program—is offered by G-E. The kit contains an instruction bulletin, a typical balance sheet for keeping historical data on each machine, planned outage forms, and checklists for motors, control and other equipment. To supplement the kit, a new slidefilm, "Productive Maintenance," is available for showing through the local G-E offices. GENERAL ELECTRIC CO., Service, Shop Div., Schenectady 5, N. Y.

**Inform-A-Gram No. C8.**

**A New Stainless Steel Handbook** is available from Allegheny Ludlum for free distribution to users of the heat and corrosion resistant metals. In its 120 pages, the cloth-bound volume discusses approximately 40 different types of Allegheny Metal stainless steel and covers each type from standpoints of analyses, fabrication, heat treatment and special conditions of service. ALLEGHENY LUDLUM STEEL CORP., 2020 Oliver Bldg., Pittsburgh 22, Pa.

**Inform-A-Gram No. C9.**

**Ball Bushings Booklet.** Thomson Industries, Inc., offers an informative, illustrated publication covering operating principle, sizes and types available, advantages, installation data, mounting arrangements and other data on their line of ball bushings. Much useful technical information is included. Write for a copy to THOMSON INDUSTRIES, INC., Dept. T&P, Manhasset, N. Y.

**Circle Inform-A-Gram No. C10.**

**The Cerromatrix Method** of punch and die setting is the subject of a current Cerro de Pasco manual. This profusely illustrated, 20-page booklet contains practical information regarding the application of this method in making various types of dies. Address CERRO DE PASCO CORP., 40 Wall St., New York 5, N. Y.

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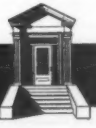

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SEE ADVERTISERS INDEX, PAGE 183, FOR KEY NUMBERS

## Society for Non-Destructive Testing

The 11th Annual Meeting of the Society for Non-Destructive Testing, Inc., one of four technical societies sponsoring this year's National Metals Congress, will be held at the Hotel Detroiter in Detroit on Oct. 15-18, concurrently with the Exposition.

Eight technical sessions will be presented with emphasis on: 1. the application of non-destructive testing to the defense production program; and 2. the latest scientific developments in the four major types of non-destructive testing—Radiography, Magnetic testing, Ultrasonics and Penetrant testing.

Programs are as follows:

**Monday Morning, Oct. 15.** Ultrasonic Testing: Sonic Comparator used on Grinding Wheels. Ultrasonic Testing of Railroad Rails. Curved Crystal Developments.

**Monday Afternoon, Oct. 15.** The Triboelectric Effect and Its Application to Sorting Metals. The Testing of Ceramics. Internal Microstrains and the Deformation and Failure of Metals.

**Tuesday Morning, Oct. 16.** Pickup and Recording of Magnetic Leakage Fields. Photoelectric Scanning of Magnetic Particle Indications. Multi-Directional Magnetic Particle Inspection.

**Tuesday Afternoon, Oct. 16.** T-V Pickup of X-Ray Images. T-V Pickup of X-Ray Images with Pin Point Aperature. Selection of X-Ray Detectors for Automatic X-Ray Inspection Applications. Intensifying the Brightness of Fluoroscopic Images.

**Wednesday Morning, Oct. 17.** Symposium on Ordnance Material Testing.

**Wednesday Afternoon, Oct. 17.** Symposium on Jet Engine Part Inspection.

**Thursday Morning, Oct. 18.** The Metallurgist's Role in the Interpretation of Non-Destructive Tests. Non-Destructive Testing Personnel Problems.

**Thursday Afternoon, Oct. 18.** Honor Lecture. Annual Business Meeting.

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Pemaco "EASY-PAK" Cartridge Type Packing Glands are manufactured for both hydraulic and air cylinders.

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(Short Runs)

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has been done with the SCLEROSCOPE *since 1907*

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**DRILL JIGS**

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*LARGE OR SMALL PARTS*

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MAXIMUM **PRODUCTION**

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**KIPP AIR GRINDERS**

***if you want to GRIND —not just rub!***

**MODEL JA**
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**IN U.S.A.**

Weight 12 ounces; length 6¾ inches; chuck size ⅛ inch. Wheel guard removed for better illustration.

**The RPM's stay up while grinding . . . not only when the grinder runs idle.**

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**SEE ADVERTISERS INDEX, PAGE 183, FOR KEY NUMBERS**

# Quality Control Convention

The American Society for Quality Control, fast-growing international organization of inspection, production and management leaders, will hold its Sixth Annual Convention in Syracuse, New York, May 22, 23 and 24, 1952.

Attendance of some 2,000 persons at the 1951 Cleveland Convention points to an assemblage in Syracuse somewhat in excess of that figure.

The American Society for Quality Control, founded in 1946, now has a membership of nearly 5,000 persons representing all types of industry and the Armed Forces, and is rapidly gaining in importance and membership because of the increased emphasis placed upon precision manufacture in postwar industry and because of the accelerated armament program.

The American Society for Quality Control has as its purpose to promote greater use of the science and techniques of quality control through indoctrination of both management and technical personnel in the statistical approach to plant problems.

The annual conventions, cementing and augmenting the work done in the Society's 50 local sections, provide an effective method for achieving this purpose.

The 1952 Convention in Syracuse will have as its headquarters the newly constructed mammouth Onondaga County War Memorial. All meetings, exhibits and official meals will take place in the modern structure which was opened to the public the first time this September.

Exhibit space in the Memorial's lower floor will be ample for displays by manufacturers of gages and testing equipment used in control work. Application of quality control in industry will be shown in other exhibits by manufacturers in varied fields who are now utilizing these techniques in the processing and inspection of their products.

The general assembly, luncheon and the banquet will afford four separate

opportunities for the complete attendance to hear major general presentations of the quality control story.

Technical sessions—as many as eight running concurrently—will provide specilized quality control information for those in attendance.

A condensed training course in basic quality control techniques, taught by highly competent and experienced control statisticians, will provide basic "know-how" for new members and will act as a refresher course for old-time control men eager to adapt themselves to today's heavier production loads and increasingly rigid specifications.

Easily accessible by train, plane or automobile, Syracuse, in the center of New York State, is well known as host to large conventions, and can provide ample hotel space and entertainment facilities.

The 1952 Convention is under the general chairmanship of Leon Bass, General Electric Co., Electronics Park, Syracuse.

Programing in general follows the highly successful plan presented at the 1951 Convention in Cleveland. One major change is the adoption of two hour sessions to replace the former three hour sessions. One two hour period will be conducted each morning or afternoon during the three days of the Convention. Thus more time will be available in which those attending can visit the popular and instructive industrial exhibit which plays such an important part in the Convention. Likewise additional time will be available for widening acquaintance and developing discussion of personnel problems in small kindred groups. Lack of time for such activity at previous conventions has been a frequently expressed criticism.

Each year quality control activity spreads to new industrial areas. The program is planned to include the stories of such expansion as well as the new and current developments in longer established areas. Papers will be presented which will be of greatest interest to those who are relative newcomers to the field of quality control. Simultaneously other presentations will give attention to the more advanced aspects of the

(Continued on page 162)

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your cutting tools
Inter-changeable cams and index plates for 1 to 14 flutes.
Inter-changeable collets up to 1.122" D.
Preloaded ball bearing spindle.
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D·S is at work in grinding rooms across the country producing better cutting, longer lived taps, counterbores, step drills, center drills, etc. Available in hand operated and motor driven models. Have you investigated it? Write today for catalog.
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## 130 Below Zero Prevents Freeze-ups [Later]

An enemy to the operating accuracy of vital aircraft instruments is internal moisture. To combat this, the aircraft and radio accessories manufacturer, Lear, Inc., of Grand Rapids, Michigan, has come up with a novel but effective use for a Deepfreeze "Sub-Zero" industrial chilling machine.

Because of the sensitivity of the components used in the production of the Lear instrument products, it is necessary to remove every trace of moisture, even to the extent of the minute quantity found in and on the metal being used. Condensation in instruments at high altitudes and low temperatures may cause the vital aircraft instruments to become inaccurate or inoperative.

In order, therefore, to prevent "snowing" in aircraft instruments subjected to the low temperatures of high altitudes, the gases used to fill instrument cases are dehydrated in the minus 130° F. temperature furnished by the unit.

Coils of copper tubing were installed in the cooling chamber of the R-120 unit. The hydrogen and helium gases are forced through this tubing and quickly chilled to approximately —130° F. The water vapor in the gas condenses out in the form of ice crystals and fine snow. The condensate is trapped by filters before it can enter the supply line. The gases are warmed to room temperature before being used to fill the instruments.

The cooling coils are cleaned periodically by "reverse-blowing" the ice and snow out. Dry helium is used to purge the hydrogen coil and dry hydrogen to clean out the helium coil.

★ ★ ★

PRODUCTION MACHINE CO., Greenfield, Mass., will exhibit for the first time their new No. 914 Centerless Grinding and Finishing Machine using wet abrasive belts, at the Detroit Metals Show this month. Seven men will be in attendance at the company's exhibit, Space F-225, Building F.

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IF
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End Mills are
all alike
WELDON
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END MILLS
offer definite superiorities
YES, Weldon Double-End End Mills have all these advantages. In addition they give you double the service for less than the cost of two single-end end mills of equal size. They save production time too, because when you want to change the mill you need only turn it end for end.
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Weldon Distributors throughout U.S.A. and Canada carry Complete stocks to serve you
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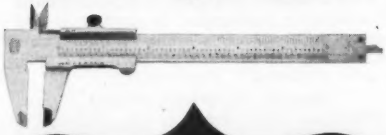
M.Z.B. *Mauser Type*
**PRECISION VERNIER CALIPERS**
*The most popular* PRECISION MEASURING TOOL *the world over*



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- Measuring capacity 5"
- Each caliper has two accurately divided scales and verniers to read .001" and 1/128" (Cat. # 30-78)
- Full visibility of scales in all positions
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- In most cases no magnifying glass needed
- Special chrome steel, spring tempered, glass hard on measuring surfaces

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**380 Putnam Avenue • Cambridge, Mass.**

SEE ADVERTISERS INDEX, PAGE 183, FOR KEY NUMBERS

. . . Convention, from page 159

subject. Others will emphasize the statistical approach. The intention of the Program Committee is to have available throughout the three days of the Convention quality control food to suit the mental digestive systems of all who attend.

The program plan is as follows:

**Receiving Inspection**

The quality control approach probably has its greatest number of devotees in receiving areas. The newest developments in procedure and sampling plans will be presented.

**Quality Verification of Finished Product**

This field is relatively new, hence many persons in all types of industry will receive benefit from stories of the use of scientific sampling for finished lots of product.

**Armed Services Use of Quality Control**

The extent to which various branches of the Armed Forces employ quality control acceptance and surveillance inspection is well-known. Many of the details which were only partly developed in 1951 will be ready for presentation at the 1952 Convention.

**Gaging Practice**

Modern gaging principles and practices are of immediate importance to production and inspection departments. The instrumentation and engineering problems of advanced gaging will be presented in these sessions.

**Specific Educational Activity**

There are three phases of this subject:

**Educational Program**

As in previous years these sessions running throughout the Convention will be designated for those who wish a brief integrated presentation of the fundamentals of quality control technique conducted by men who know the principles, have had experience in industrial application, and are experts in presenting the subject.

**A Special Session on Training Activities of Society Sections**

This is designed to bring together all persons concerned with or interested in educational work at the sectional level. The program will be semi-formal, semi-roundtable. To no small degree the future of the Society is bound up in the educational activities of the Sections. This session will serve as a clearing house for information concerning such activities.

**What is Quality Control?**

This session will be devoted to an intensive analysis of the perplexing unanswered question of what plant activities properly belong to the quality control department? . . . What

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and HIGH Production . . .
USE
MOTCH & MERRYWEATHER Master-Cut
SLITTING and SLOTTING SAWS
Better, but no higher priced—M. & M. Master-Cut slitting saws. Strong tooth form. Ample side clearance and flat hub avoid binding. Firm clamping, accurate cutting. Exclusive Dual Drive or conventional key drive.
Less breakage with Dual-Drive!
See your local dealer for quick service.
THE MOTCH & MERRYWEATHER MACHINERY CO.
PENTON BUILDING CLEVELAND 13, OHIO
COMMAND OUR UNPARALLELED EXPERIENCE IN CIRCULAR SAWING

are its functions? . . . Where are its boundaries? . . . What should be its objective? . . . What are its relations to other plant functions?

**General**

At any convention there are many persons who have a broad though not specifically defined interest in the subject of the meeting. For these and many others whose field of activity cannot be covered by separate programs a series of applied presentations of method, procedure and technique has been set up to run at each of the four periods.

**Programs in Specific Fields**

Quality control has become an integral part of operations in most of the basic industries of our producing system. Representatives of these industries will be able to attend programs designed to keep them abreast of recent developments, new techniques, or unique applications in their fields. Programs have been set up in the following fields:

Electronic and Electric, Chemical, Automotive, Aircraft, Food, Textile, Paper and Pulp, Ferrous Metals, and Non-ferrous Metals.

**Mathematical Statistics**

Another program patterned after the very successful one in Cleveland has been set up to bring to the quality control audience mathematical statisticians who are prepared to present the background, thinking and approach which characterizes the underwriting science of quality control.

★ ★ ★

## CLEARING BUYS OHIO PLANT

Purchase of a factory building of approximately 100,000 square feet working area in Hamilton, Ohio, has been announced by Clearing Machine Corp., Chicago press manufacturers. The new plant, which was purchased complete with machinery and equipment from the Hamilton-Thomas Corp., will be utilized immediately in expanding the production of the Chicago concern to meet urgent defense requirements. A working force of some 250 persons has been making Liberty planers and other machines in the plant, and the new owners will continue that business also, retaining the same workers and supervisors.

With the purchase of the Hamilton property, Clearing has abandoned plans to erect a factory building on recently acquired land in Joliet. Material shortages would have delayed construction so that many months of production would have been lost.

SEE ADVERTISERS INDEX, PAGE 183, FOR KEY NUMBERS

## 130,000 Recruited for Defense Work

A nation-wide labor clearance system of the United States Employment Service and affiliated State Employment services has been operating in recent months to help alleviate key manpower shortages in both industry and Government.

So useful has the system become that some 130,000 job placements of "key" and "scarce" workers have been made in the year following the Korean outbreak, Secretary of Labor Maurice J. Tobin has reported.

Mr. Tobin said that the labor clearance system has worked to bring jobs and workers together in occupations and locales where shortages exist. Wherever one locality has job shortages and another job applicants, the labor clearance machinery has gone into action to fill both employers' and job seekers' needs.

By means of the State-Federal labor clearance system, workers are recruited locally first, then within the State in which the job exists, and, finally from outside the State.

Local offices of the public employment service collaborate on a State, regional and national basis in the job placement of workers who cannot be recruited locally. But the fixed policy is to exhaust all local labor resources before an employer's job order is placed outside an area, Mr. Tobin said.

One of the objectives is to avert unnecessary competition for scarce workers.

According to Robert C. Goodwin, director of the Bureau of Employment Security, this is the way the system operates:

When the local employment office gets an order, it first checks its own file for workers. The available supply not meeting the demand and clearance given, the order is relayed to other public employment offices within the State.

6 WEEKS!
"THAT'S LIKE TOMORROW IN NORMAL TIMES"
1951 CALENDAR 1951
When this was written, we were giving 6 weeks delivery on our standard (and standardized) gearless drillheads
4" to 15½" head diameter
Maybe we can still do it! ASK US NOW!
ZAGAR TOOL, INC., 24000 Lakeland Blvd., Cleveland 23, O.
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TOOLS FOR INDUSTRY and SPECIAL MACHINERY

If the workers are not available in other local offices in the State, the order goes out to offices in other States. If the workers are not recruited in adjacent States, the job order is extended in non-contiguous States. Finally, it can be forwarded to the Bureau of Employment Security in Washington for clearance to more distant States.

Under a "positive recruitment" program, the employer participates directly in the recruitment process. He sends teams along a scheduled route arranged by the employment service after consultation with the employer.

The recruitment teams use the local offices of the employment service to interview prospective workers selected by local office employment interviewers according to job specifications of the employer's order.

According to Labor Department statistics, a current inventory of job openings placed in clearance because jobs could not be filled locally, reveals some 61,600 jobs to be filled. Of the total, approximately 10,400 are in the professional and managerial category, predominantly openings for engineers—civil, chemical, electrical, industrial and mechanical.

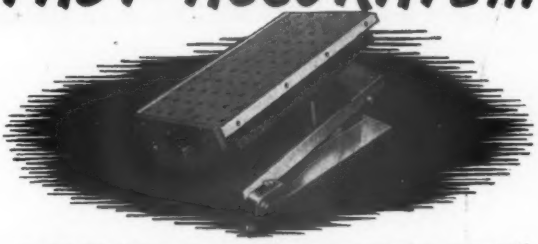
As of mid-July, employers' orders for more than 20,500 skilled workers had been placed in clearance. These included machinists, toolmakers and die sinkers, blacksmiths, forgemen and hammermen, miners and mining machine operators, airplane mechanics, tool sharpeners and manufacturing foremen.

Also on hand were orders for 7000 typists and stenographers.

In the semi-skilled field are orders for aircraft workers, machine shop workers, textile workers, chauffeurs and drivers.

Private firms for whom the clearance system has been operating include the largest defense contractors, some of them engaged in classified or secret projects on which loyalty clearance is required.

FAST-ACCURATE...



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the SINE-PLATE

Now angular inspection set-ups as accurate as the measuring instruments used can be made in a few moments. Any angle, single or compound, is set up by inserting standard gauge blocks between the Sine-Plate plates. Proper size blocks are indicated for all angles in table supplied. Saves hours of set-up time, guarantees accurate inspection. In two sizes; also magnetic models for machining operations.

SEND FOR CATALOG

OMER E. Robbins COMPANY

Manufacturers of the MAGNA-SINE and Other Precision Tools

5722 TWELFTH ST. • DETROIT 8, MICH.

SEE ADVERTISERS INDEX, PAGE 183, FOR KEY NUMBERS

## Reinforced-Plastic Reduces Production and Assembly Costs

A recent switch from aluminum to reinforced-plastic housings for photo-electric engraving machines has added up to some impressive cost reductions.

The Fairchild Camera and Instrument Corporation of Jamaica, N. Y., is saving substantial sums each month as a result of the new housings. Savings in actual production costs alone are estimated at from $300 to $500 per month. Add to these the savings that come from easier, faster assembly on the production line, and the advantages of replacing aluminum with plastic become even more impressive.

The new reinforced-plastic housing is far superior to the old aluminum ones. Aluminum housings were welded of five different stamped parts. Tolerances were difficult to hold, necessitating frequent production-line adjustments. And they were expensive to make.

Plastic housings, on the other hand, can be held to the closest tolerances and rejects have been reduced almost to zero. The only finishing operation is the sawing of the parting line. In actual use, the plastic housings have proved to be much more dent resistant and durable than the aluminum ones.

The Le Conte Plastics Co. of Babylon, N. Y., is making the plastic housings. They are made of American Cyanamid Company's LAMINAC Resin, reinforced with two layers of Fiberglas. A copper screen incorporated into the "lay-up" serves to ground stray electrical currents.

To produce this housing, Le Conte began making a plaster model of the housing, applying a parting agent to it, then casting a female form in plaster from the model.

The model was removed and replaced by pattern-maker's wax. Against this

For repetitive cutting...
THIS COMBINATION SAVES TIME AND MONEY
ANY quantity of identical lengths of bar stock are cut automatically in a Wells No. 12 Heavy Duty Metal Cutting Band Saw equipped with a Wells-O-Bar Feed Master.
In operation, the cutting head of the saw descends at a rate governed by a predetermined blade pressure setting. At the completion of each cut, the head automatically rises to a preset height and the stock is automatically projected for the next cut. The machine requires no attention except for reloading. Ask your Wells Dealer for complete information or write direct.
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METAL CUTTING BAND SAWS
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1940 CEDAR ST., THREE RIVERS, MICH.

wax, a plaster male form was molded. Then a foundry took over and made aluminum molds from these two plaster ones.

The making of the housing itself begins by cutting to pattern the two layers of Fiberglas and the copper screen. (For preliminary shaping, these sheets are stapled to a wooden male form that corresponds to the male part of the mold.)

The sheets are put in the aluminum female mold and the mold is closed with the male one. Because a smooth surface is needed on both sides of the housing, and because hardly any pressure is used during the molding, the resin must be applied after the mold is closed, which presents an interesting production problem.

Le Conte developed a process of injecting the resin into the mold from a specially designed resin pot. The pot is connected to a small opening in the mold by a hose. To make the resin flow through the hose, two other connections were made, one for exerting air pressure in the pot, another for creating a light vacuum in the mold. The latter connection, in addition to aiding in the resin flow, eliminates "starved spots" caused by trapped air.

When the mold is filled, it is cured in an air circulating oven. Then the housing is removed from the mold and placed on a jig to insure uniform trim. The parting line is finished by a sawing operation.

## It's No Circus

Expansion of operations necessitated by increased orders exceeded the speed of construction by building contractors and recently forced the Pivot Punch & Die Corporation of North Tonawanda, N. Y., to work practically "in the open." Employees cheerfully worked under a large tarpaulin that protected them from the sun and rain while the walls, ceiling and roof of a factory expansion were being constructed about them.

The 20% increase in factory space was required by increased orders resulting from the company's recent inauguration of a service that offers more than 276,000,000 punch sizes and styles.

If you have to HOLD

ANYTHING in your production operations

Hold EVERYTHING with "DE-STA-CO" Toggle Clamps in welding, riveting, bonding, machining and assembly. • Fast clamping, positive holding pressures, instantaneous release—Toggle Clamps speed up your operations and cut your costs. • There are more than 40 different Toggle Clamps manufactured by Detroit Stamping Company in various types and sizes to meet industry's requirements.

MODEL 424
PORTABLE PLIER CLAMP
For one-hand use in cramped work areas and small space. Deep jaw capacity but only 4½" in length.

MODEL 650
HEAVY DUTY PLUNGER CLAMP
For "push-pull" work-holding jobs where considerable pressure is needed. Compact; up to 4000 lbs. capacity.

MODEL 235-U RETRACTABLE CLAMP (Not illustrated)
Quick, unimpeded loading and unloading of fixtures easily possible with this one. Up to 750 lbs. pressure.

Ask for "DE-STA-CO" Toggle Clamp Catalog and name of representative nearest you who is stocking our entire line of Toggle Clamps.

DE-STA-CO DETROIT STAMPING COMPANY
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SEE ADVERTISERS INDEX, PAGE 183, FOR KEY NUMBERS

# "Probograph" Precision Measuring Method

The "Probograph" method is a new system of high precision measurement that can be used for mass inspection and gaging as well as for scientific and engineering work. It is essentially an instrument in which each measurement is recorded, but it has also been applied to the grading of parts, sorting them into 16 or more categories.

The Probograph can be used: 1. in inspection and quality control; 2. in the shop for grading and setting-up; 3. in the laboratory for research and engineering; and 4. in the gage and tool room for checking and maintaining masters.

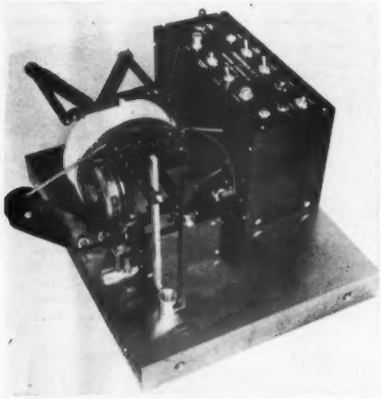


Photo courtesy Industrial Scientific Co.

The Probograph name stems from the fact that an electrical "probe" is utilized to take dimensional readings of a part, and these readings are transmitted by electrical and electronic means to a recording or stylus unit, where all measurements are recorded in a self-explanatory presentation in the form of a "graph." In those installations where the Probograph is used for grading and sorting, the stylus or recording unit is replaced by an electrically operated automatic grader.

Probes used in the line of Probograph instruments are usually needle shaped and pointed to a radius of .001", and tungsten carbide tipped. For certain purposes, spherical, cylindrical and flat probes are used. The probes are resiliently and adjustably mounted in probe holders.

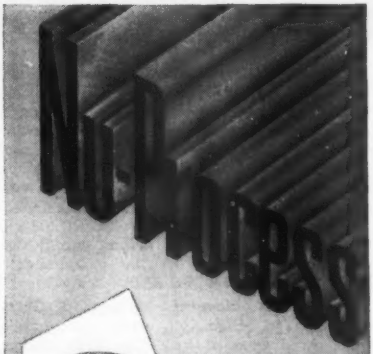
The graph is produced on electrosensitive Teledeltos recording paper by an electric stylus that closely resembles a phonograph needle, but that acts only as a conductor and does not emboss or perforate the paper. A distinct black mark is produced on the paper wherever current flows through the stylus.

Operating principle is as follows: The probe is moved by a precision slide movement toward the part under measurement, and upon making contact with the part, a minute electric current passes through the probe. The stylus moves over Teledeltos paper simultaneously and in synchronism with the probe but at a higher ratio. The electric impulse from the probe, upon making contact with the part, is transmitted through an electronic system to the stylus, and the graph is produced by distinct, point-shaped black marks that appear on the recording paper, showing the exact position at which contact was established between probe and part. Ratios between probe movement and stylus of from 10:1 to 300:1 are used. The graph thus shows a magnified presentation of the dimensions under measurement.

The basic principle can be utilized and modified in many different ways for various applications including measurement of: center hole distances in watch plates; contours of airfoil sections, such as gas turbine compressor blades and buckets, at a rate of 120 blades per hour for 100% inspection; automotive cams; gears of all types; center hole distances in large parts; and aircraft propellers.

One Probograph model comprises a line of instruments for sorting small, intricate parts such as supercharger blades and similar parts, including threaded bushings.

All Probograph measurements are referred to a standard in the form of a gage pin or gage block so that all measurements are directly related to the accepted measuring standards.

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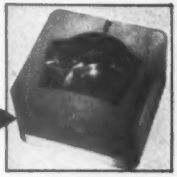
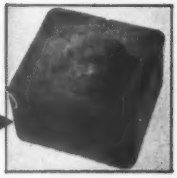


not this ➡



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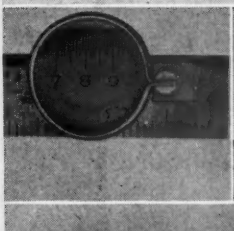
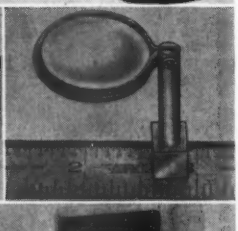
# PROGRESS

NEW DEVELOPMENTS • IMPROVEMENTS • COST AND TIME SAVERS





**The Carson-Dice Electronic Micrometer** assures rapid and accurate measurements to a tolerance of .00002". An electronic circuit, used with an extremely accurate micrometer head, permits "pressureless" measurement and eliminates "feel" as a source of error. This instrument can be used for measuring machined parts, ball bearings, small assemblies, depths of counterbore, etc. J. W. DICE CO., Dept. T&P, Englewood, N. J., can supply details.

**Circle Inform-A-Gram No. A1.**

**The Magnet Mounted Magnifying Glass** made by The Miller Co. leaves both hands free to hold work or tool. This high quality lens is mounted on a genuine Alnico magnet at the proper height to provide maximum magnification without distortion. It grips any steel surface, rule, square or machine. Complete information is obtainable by writing to THE MILLER CO., 408 E. Elm Ave., Waseca, Minn.

**Circle Inform-A-Gram No. A2.**

**The Sigma Multi-Dimension Inspection Machine** is being introduced in the U.S. by Cosa Corp. Designed for 100% inspection, this machine checks pieces simultaneously for inside and outside diameters, depths, profiles, tapers, concentricity, squareness of surfaces, threads and other characteristics. Inspection results are shown by signal lights on a panel. It is available for hand, semi-automatic or fully automatic operations. Write COSA CORP., 405 Lexington Ave., New York 17, N. Y., for further data.

**Circle Inform-A-Gram No. A3.**

**Fonda Lifetime-Carbide Gage Blocks** (outside cut) outlast steel blocks in wear and accuracy. Time between inspections is greatly extended, thereby reducing this expense. They are guaranteed not to grow or shrink over any period of time. FONDA GAGE CO., 59 Daly St., Stamford, Conn.

**Circle Inform-A-Gram No. A4.**

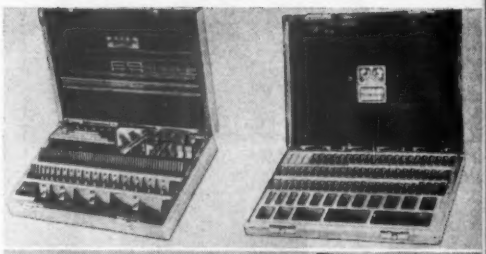
**A Combination Surface & Angle Plate** of black granite is offered by Rahn. Inside cut shows an 18" x 18" granite surface plate, attached to the squared edge of a 24" x 36" granite surface plate. Surfaces are finished by a hand lapping process to an over-all tolerance of .00005" on each plate. The edge of the larger plate is lapped to 90° with the top surface so that, when the two plates are bolted together, every part of the projecting 18" x 13" is within .0002" of 90° with the plane of the larger plate. RAHN GRANITE SURFACE CO., 641 N. Western Ave., Dayton 7, Ohio.

**Circle Inform-A-Gram No. A5.**

# ON PARADE

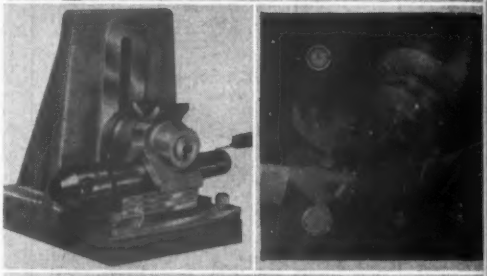
Mail FREE Inform-A-Gram Card for MORE Details.

**Solid Carbide Precision Gage Blocks**—both Hoke (left) and USA—can now be furnished by Pratt & Whitney. They are available in all sizes .050" up to and including 4". The Hoke Blocks are square design; the USA, rectangular. One-inch blocks and smaller are accurate to a tolerance of +.000004" and —.000002", and sizes over 1" are accurate to the same tolerance per inch of length. Write to PRATT & WHITNEY, 15 Charter Oak Blvd., W. Hartford 1, Conn.
**Circle Inform-A-Gram No. A6.**

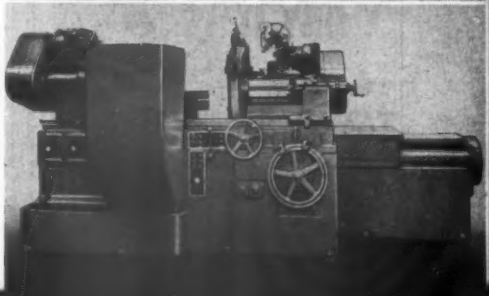


**The Improved Dillon Tens-O-Trol System** measures tension, weight or tractive loads **remotely.** It is electro-mechanical in design and is now equipped with oversize selsyn motors for added torque and increased dependability. Alterations have been made in cabinet size, appearance and dial layout. W. C. DILLON & CO., INC., 1421 S. Circle Ave., Forest Park, Ill.
**Circle Inform-A-Gram No. A7.**

**The Webber Taper-Chek Fixture** (inside cut) simplifies the job of inspecting tapers. Instead of using comparator, sine bar or spaced roll, the operator assembles the proper combination of angle blocks. The blocks are then mounted with the work on the Taper-Chek and an indicator reading is taken. It takes less than two minutes and taper is checked accurate to within .000020" in 4". Write WEBBER GAGE CO., 12903 Triskett Rd., Cleveland 11, Ohio, for details.
**Circle Inform-A-Gram No. A8.**



**The FOROTAST Inside Gage** (outside cut) is a new instrument for testing inside diameters, with a guaranteed accuracy of transmission of .0000591". The transmission element consists of a rotating connector with two rounded slots, set 90° apart on its periphery. The feeler rod and dial connector rod fit tightly into these slots, insuring accuracy. The positioning of the slots makes it possible to withdraw the feeler rod by pressure on the push rod of the indicator dial. Address KARL A. NEISE, Dept. TP, 381 Fourth Ave., New York 16, N. Y.
**Circle Inform-A-Gram No. A9.**



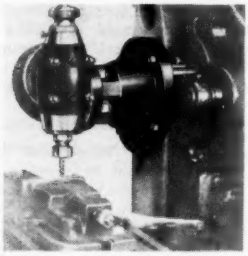
**The Norton Aircraft Strut Grinder,** built especially for grinding the components of landing gear mechanisms used on large planes, offers a swing capacity of 80" or 86" by means of a gap. It is arranged for a 26" or 32" dia. swing over the table, and is available in work length capacities of 72" and 96". NORTON CO., 1 New Bond St., Worcester 6, Mass.
**Circle Inform-A-Gram No. A10.**

**The Detroit Sheet Metal Ductility Tester** features hydraulic clamping device, one-knob

control, excellent visibility and easily removable grips. Load gages are of large diameter, permitting wide graduations and fine reading. DETROIT TESTING MACHINE CO., 9390 Grinnell Ave., Detroit 13, Mich., will provide detailed literature.

**Circle Inform-A-Gram No. A11.**

**A New Micrometer Precision Vertical Milling Head,** for angle boring and milling on horizontal milling machines, is announced by Brown Mill Tool Co. This all-universal precision tool has a micrometer, vertical quill spindle feed calibrated in .001" increments. The travel of the vertical spindle is 1¾" to 3". The ground thread micrometer lead screw has a navy bronze stud for spindle end thrust support with set screw take-up adjust-



ment. Adjustments are easily made with an ordinary Allen wrench. For further information and prices, write to BROWN MILL TOOL CO., 5443 San Fernando Rd. West, Los Angeles 39, Calif.

**Circle Inform-A-Gram No. A12.**

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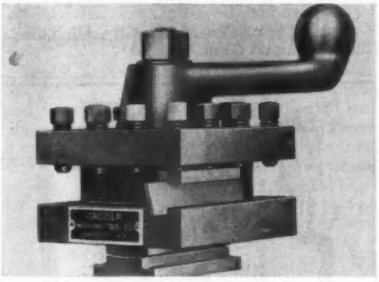
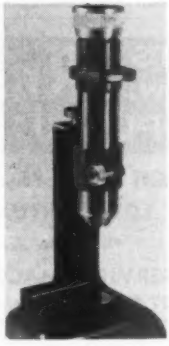
**A New Model Metalometer** with Peabody Anvil attachment is announced. New features of the Metalometer include tungsten point, micro interior finishes and trigger release mechanism. The anvil widens the application of surface hardness testing of small parts to include tool bits, gears, drills, etc. PEABODY INDUSTRIES, INC., 12129 Hamilton Ave., Highland Park 3, Mich.
**Circle Inform-A-Gram No. A13.**

**Crozier's Tool Post Turret** now has a 12 position index feature by which the turret may be aligned with the work with the compound rest of the lathe set at any 30° angle.



This addition further increases the speed and efficiency of lathe operation. A cut-off tool and holder are standard equipment with this turret. CROZIER MACHINE TOOL CO., Dept. T&P, Hawthorne, Calif.
**Inform-A-Gram A14.**

**The P.G. Cutter Grinder Microscope** checks radii, forms and angles of engraving tools, small twist drills and similar tools that carry an irregular shape at the end of a cylindrical shank. It consists of a 15X magnifying microscope with detachable reticle. Complete details are obtainable from J. ARTHUR DEAKIN & SON, 150-28 Hillside Ave., Jamaica 2, N. Y.
**Inform-A-Gram A15.**

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| 3/16"x12" | 2.06 |
| 13/64"x12" | 2.19 |
| 7/32"x12" | 2.19 |
| 15/64"x12" | 2.40 |
| 1/4"x12" | 2.40 |
| 17/64"x12" | 2.55 |
| 9/32"x12" | 2.55 |
| 19/64"x12" | 2.75 |
| 5/16"x12" | 2.75 |
| 21/64"x12" | 3.11 |
| 11/32"x12" | 3.11 |
| 23/64"x12" | 3.46 |
| 3/8"x12" | 3.46 |
| 25/64"x12" | 3.81 |
| 13/32"x12" | 3.81 |
| 27/64"x12" | 4.17 |
| 7/16"x12" | 4.17 |
| 29/64"x12" | 4.52 |
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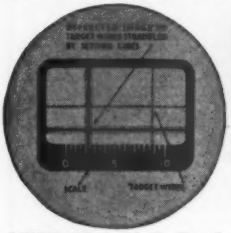
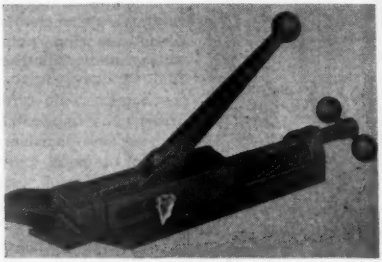
**The Improved Watts 18" Microptic Auto-Collimator** determines and checks straightness, squareness and inclinations to one-half second of arc (.0000025" per inch of length). It operates on the optical principle that a beam of light reflected by a mirror is deflected if the mirror is tilted and that the angle through which the reflected beam is turned is twice the angle of tilt of the mirror. A yellow filter and convenient scale provide for precise and comfortable reading. ENGIS EQUIPMENT CO., 431 S. Dearborn St., Chicago 5, Ill.



**Circle Inform-A-Gram No. A16.**

**The DI-ACRO Quik-Lok Clamp** is available for all No. 2 and No. 3 DI-ACRO Benders now in use and can be readily mounted by merely bolting it onto the bender base. This quick acting clamp is ideal for use when bending tubing, angle, channel and extrusions as it locks the material securely. Its wide opening jaws allow easy removal of the perfectly formed part. It can be adjusted for any radius to 9". O'NEIL-IRWIN MFG. CO., 315 Eighth Ave., Lake City, Minn.



**Circle Inform-A-Gram No. A17.**

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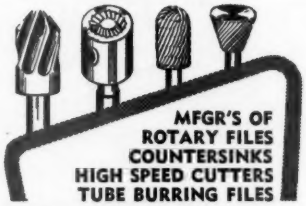

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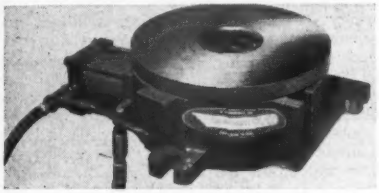
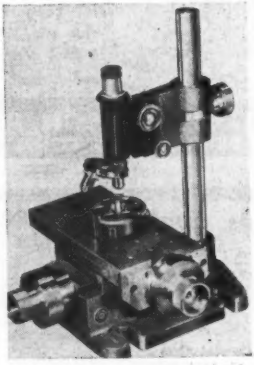
**A New and Better Heavy Duty, Air Controlled Index Table, Model H,** is now offered by Air-Hydraulics, Inc., with a positive and accurate indexing mechanism. The table is fitted with radial and thrust ball bearing. The bearing surface of the plate is ground and



hard chrome plated for accuracy and long life and may be mounted horizontally or vertically. Model H is made with 4, 6, 8, 12 or 24 stations and is so designed with a station location ring, which may be interchanged to give any variations desired. AIR-HYDRAULICS, INC., 811 Belden St., Jackson, Mich., will supply details.

**Circle Inform-A-Gram No. A18.**

**The E & G Compound Microscope Base** is designed for tool, die and instrument makers and features a longitudinal travel of 6" and transverse travel of 4". Made with calibrated drums reading directly to .0001", it has hold-down ears on 6" centers that permit mounting on mills, jig borers and surface tables. Dovetail ways permit large and non-symmetrical parts to be bolted to the table without bind-



ing. Examination of large parts is possible by means of an extension arm placing the microscope body 18 to 24" from the table. Address requests for descriptive brochure to ERB & GRAY, 854 S. Figueroa St., Los Angeles 17, Calif.

**Circle Inform-A-Gram No. A19.**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COMPARE FOR PRICE
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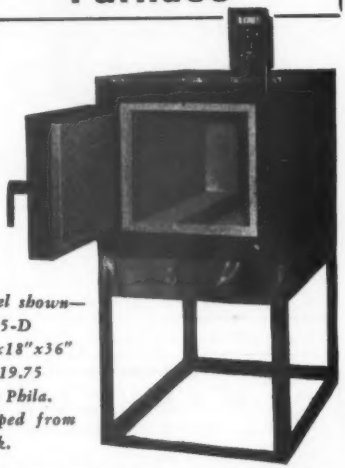
LUCIFER
Furnace



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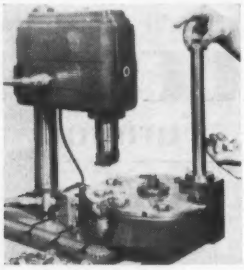
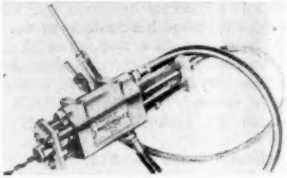
**The Automark Automatic Marking Machine** will be featured in Cadillac Stamping Company's booth, No. H-258, at this month's Metal



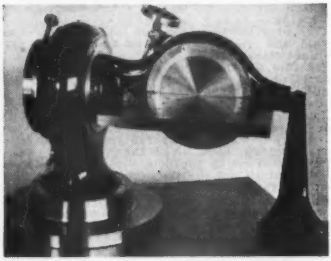
Show. This air-operated marking machine is especially adapted for light, flat marking. It has been tooled to mark as many as 15,000 parts per hour. The illustration shows a dial feed adaptation for marking brass nuts at a rate of 3000 per hour. Also included in the Cadillac exhibit will be the Cadillac 45 Hydraulic Marking Machine, the Automark Electrical Metal Marking Typewriter and other components of the company's line of metal marking devices. CADILLAC STAMP CO., 17315 Ryan Rd., Detroit 12, Mich.
**Circle Inform-A-Gram No. A20.**

**The Commander Multi-Angle Drill Unit** has been designed to provide unlimited freedom of setup to simplify and reduce the cost of drilling holes at any angle. Powered by a heavy duty flexible shaft with hydraulic actuation of the full 4" stroke, the unit is a compact drill head that can be easily mounted on jigs and fixtures or built into special machines. Because of their compact design, a number of the Multi-Angle Units can be mounted on a jig or fixture to drill multiple holes in a single piece with great savings in time and production cost. Write for full data



to COMMANDER MFG. CO., 4228 W. Kinzie St., Chicago 24, Ill.
**Circle Inform-A-Gram No. A21.**


**64 MANHOURS Saved on One Job**



A precision forging in a large aircraft plant had 17 angles of which 9 were compound angles. Checking by the usual method required two men working a total of **96 hours**

The job with a Universal Angle Computer was done by one man working only **32 hours**

a saving of 64 manhours on each forging.

*Let us send further details.*

**ANGLE COMPUTER CO., Inc.**
1709 Standard Ave., Glendale 1, California

*New* **NESTING TYPE TOTE PANS**

20" Long x 12" Wide x 6¼" Deep 16 Ga., drag holes, handles both ends.

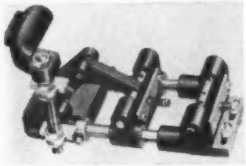
**J. L. LUCAS & SON, INC.**
BRIDGEPORT 5, CONN.

**FROM STOCK**
**STEEL ARBOR SPACER SHIMS**
**IN SETS**
2 Popular Sizes
⅝", 1", 1¼" Bore

19 pieces per set from .001 to .125
$1.50 per set

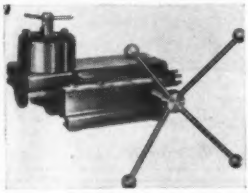
**Grand Tool & Supply Company**
231 Centre St. New York 13, N. Y.
Tel. Worth 4-6671
Drills — Taps — Dies — Reamers, etc.

**The "Surefeed"** is a new positive action automatic feed that is simple in design, rugged in construction, easy to mount and quickly



set up for required feed length. It is mounted directly on the die set. Stock up to 2" wide and .045" thick can readily be fed. THE PRODUCTO MACHINE CO., 970 Housatonic Ave., Bridgeport 1, Conn.
**Circle Inform-A-Gram No. A22.**

**The Heavy Duty Newton Precision Bed Turret** has been improved as follows: all-steel turret head accommodates six tool positions



and is self-indexing; pilot wheel operation is now a feature; and a hardened and ground tool steel mechanism assures repeating accuracy. A. K. TOOL CO., 2029 Blake Ave., Los Angeles 39, Calif.
**Circle Inform-A-Gram No. A23.**

**Haskel Hydraulic Power Units.** This complete line, combining reservoir, pump and motor into a compact, efficient unit, contains 224 standard models. Tank sizes are selected

for given power requirements to provide adequate cooling of oil under normal usage. HASKEL ENGINEERING & SUPPLY CO., 721 W. Broadway, Glendale 4, Calif.
**Circle Inform-A-Gram No. A24.**


# "M-B"
## "SUPER-SPEED"
## *Pneumatic*
## GRINDER

**Model SS-SR**
**100,000 RPM**

The **ONLY** hand grinder with spindle speed of 100,000 R.P.M. on 100 pounds air pressure. It has revolutionized hand grinder performance. Can be directed in any working position; operates with extreme ease. Steel Construction throughout. Formed to fit the hand. Weighs only 14 ounces. **NOTE SPEED** such as to operate Tungsten Carbide Burs, Rotary Files, etc. to their **FULL** efficiency.

**Also Other Models and AUTOMATIC AIR LINE FILTERS, REGULATORS and LUBRICATORS**

*"Remember, Built-in Quality Remains Long After First-Cost Disappears"*

**Write for Literature**

*Representatives in Principal Cities*

**M·B PRODUCTS**
**46 Victor Avenue**
**Detroit 3, Michigan**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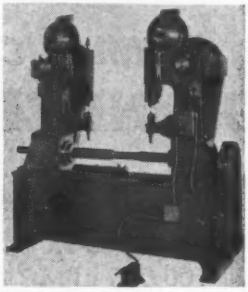
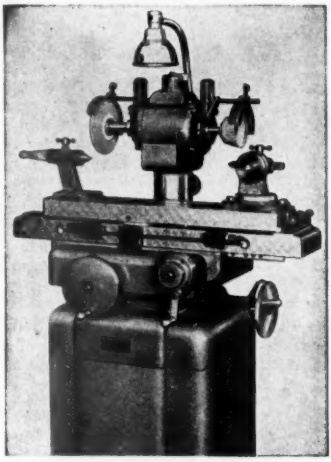
**A New "Dual Rivitor,"** designed to save time and labor in assembly, has been developed by Tomkins-Johnson Co. It is equipped with 10" hoppers and tooled to automatically feed and set two ¼" dia. x ⅝" long rivets at a time. It consists of two 8" Model "R" Rivitors, mounted face to face on a common base. Details on adaptation of T-J Rivitors to your needs can be had from TOMKINS-



JOHNSON CO., Dept. T&P, Jackson, Mich.
**Circle Inform-A-Gram No. A25.**

**New Model B800 Series Universal Tool & Cutter Grinders** of K. O. Lee Co. feature improved accuracy standards, greater capacities, 25% heavier construction, improved lubrication system giving longer life, and many refinements for easy operation. Descriptive

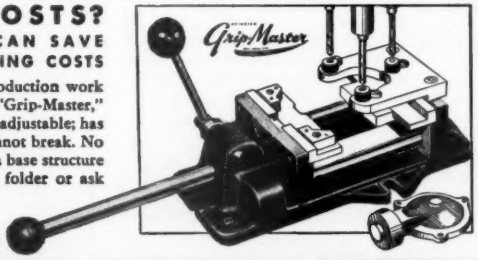


literature containing full details is offered by K. O. LEE CO., 1113 First Ave., Aberdeen, S. Dak.
**Circle Inform-A-Gram No. A26.**

**HAVE TO CUT COSTS?**
**THIS SCREWLESS VISE CAN SAVE YOU UP TO 75% ON TOOLING COSTS**

*Extra* time and labor savings in production work can be yours when you use Heinrich "Grip-Master," the original screwless vise. Instantly adjustable; has positive lock that hammer blows cannot break. No leveling of work necessary. Ideal as a base structure for jigs and fixtures. Write for free folder or ask your Dealer for a demonstration.

**NATIONAL MACHINE TOOL CO.**
Dept. 131-K Racine, Wisconsin

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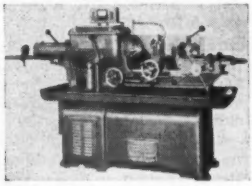
HAND WHEELS — Straight or Dished
CAST IRON HAND KNOBS — Standard or Long Shank
CLAMPING HANDLES — Straight or Offset
THREADED PLASTIC BALLS — Oval or Round

ALSO SCREW CLAMPS, MACHINE VISES, FIXTURE UNITS, MAGNETIC BLOCKS AND ROTARY TABLES. *Write for Catalog and Prices on Complete Reid Line*

**REID TOOL SUPPLY CO.** 709 Baker Street—Muskegon Heights, Mich.

**The New Simmons No. 2 Turret Lathe,** with 1¼" bar capacity, utilizes standard assemblies and eliminates complex devices. It is designed for rapid production of precision



parts and a variety of bar and chucking operation. Write SIMMONS MACHINE TOOL CORP., Dept. T&P, Albany 1, N. Y.
**Circle Inform-A-Gram No. A27.**

**A 4" Jaw Fast-Operating Hydraulic Machinists' Vise** is announced by The Columbian Vise & Mfg. Co. New No. 1004 is substantially heavier (weighs 80 lbs.) than previous models and possesses higher and wider jaws. Maximum hydraulic pressure is 7000 psi, and maximum jaw pressure is 4000 lbs. THE COLUMBIAN VISE & MFG. CO., 9021 Bessemer Ave., Cleveland 4, Ohio.
**Circle Inform-A-Gram No. A28.**

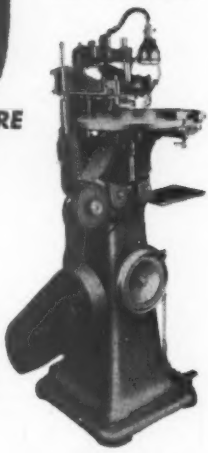
**Two New Kenco Power Presses,** the Standard 5 Ton, Variable Speed, and the 4-in-1, 5 Ton Variable Speed, with ram speeds suitable for deep drawing, piercing and blanking, have been developed. Details on features can be

had from KENCO MFG. CO., 5211 Anaheim-Telegraph Rd., Los Angeles 22, Calif.
**Circle Inform-A-Gram No. A29.**


**REDUCE MAN-POWER PROBLEMS**

**SKILLED LABOR Is NOT Required**

***WHEN YOU'RE EQUIPPED with***



**OLIVER DIE MAKING MACHINES**

**Tried and proven, OLIVER Die Making Machines help lower production costs — so simple to operate that skilled labor is not required . . . this, with their efficiency, speed and accuracy, result in time and cost savings up to 60%. Many OLIVER Die Makers have been in continuous use for more than 25 years. Find out for yourself why plants throughout the Nation are employing thousands of OLIVER Die Making Machines for sawing, filing and lapping operations.**

**OLIVER DIE MAKERS**
**Available in 5 Models**

**The Bench Model S-1 (illustrated) is a single speed die maker for use on tool steel up to 1" thick.**

**The Heavy Duty Model (illustrated) has 6 speeds, works in metal up to 3" thick, has variable strokes to 5" with hydraulic feed.**

***Write Today For Complete Technical Data on* OLIVER DIE MAKERS**

**OLIVER INSTRUMENT CO.**
1414 E. MAUMEE · ADRIAN, MICHIGAN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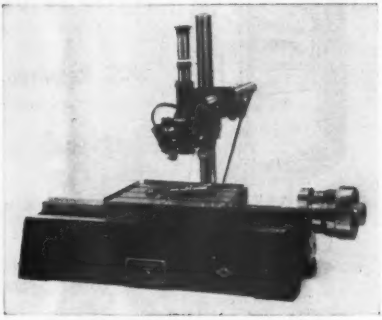
**With the Boeckeler No. 2 Optical Micrometer,** any measurement can be made that can be made with any expensive toolmaker

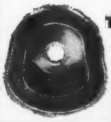


microscope. Although cross action is not featured, the work can be surveyed in X and Y coordinates. Also, through action of the overarm, it is possible to position the microscope body tube as desired over any line of motion of the object. Accuracy is to .000010". Other features include a 10½" range, measurement on stepped objects, a plate level to verticalize the microscope, and great capacity of weight and bulk. Write THE BOECKELER INSTRUMENT CO., P. O. Box 181, Tucson, Ariz., for descriptive literature.
**Circle Inform-A-Gram No. A30.**

**The Starrett No. 652 Universal Dial Bench Gage** is designed for fast, accurate and economical inspection of all types of small parts. Plus or minus variations from size in .0005" can be read off instantly from the indicator. Readings are uniformly accurate because of predetermined spring contact pressure entirely independent of the operator's "feel." The ground and lapped table is adjustable vertically on the ground post to suit various thicknesses of work. THE L. S. STARRETT CO., Dept. T&P, Athol, Mass., will supply more detailed information.
**Inform-A-Gram A31.**

**DRILL THESE HOLES**
**BY A QUICK, EASY, INEXPENSIVE METHOD**
Your business letterhead will bring literature.
**WATTS BROS. TOOL WORKS**
Wilmerding, Penna.

EISLER JIG BORING
**CAM MILLING**
A SPECIALIZED ROWBOTTOM CAM MILLING SERVICE... JIG BORING... SPOT WELDING... CONTRACT PRODUCTION ... EXPERIMENTAL DEVELOPMENT



EISLER ENGINEERING CO., INC.
732 S. 13th Street (Avon Ave.)
Newark, N. J.

**SUPEREAM**

**REAMERS IN *Decimal* SIZES**
From .032 all the way up—Blanks can be ground to your exacting specifications and delivered in approximately 10 days. By purchasing SUPEREAM REAMERS in steps of .001 you SAVE—Time, Labor and Money in the cost of extra machining and lapping. SUPEREAM REAMERS all have ground and polished flutes and are held within .0002 tolerance. REAMERS are also furnished in Right-hand spiral, right-hand cut, as well as Left-hand spiral, right-hand cut.
*Write for descriptive literature and prices.*
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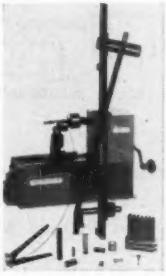
TWENTIETH CENTURY MANUFACTURING CO.
1720 MONTROSE AVENUE CHICAGO 13, ILLINOIS

**The New Metron Tachometer** measures the speeds of many machines from one convenient location. Employing a simple machine selector knob, it reduces first costs and operating expenses by eliminating duplicate tachometer indicators and saving steps and time of the operator. A wide selection of over 50 standard full scale range markings are available, all with large, easy-to-read graduations. No speed changing drives are required. METRON INSTRUMENT CO., 432 Lincoln St., Denver 9, Colo.

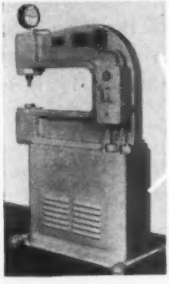
**Circle Inform-A-Gram No. A32.**



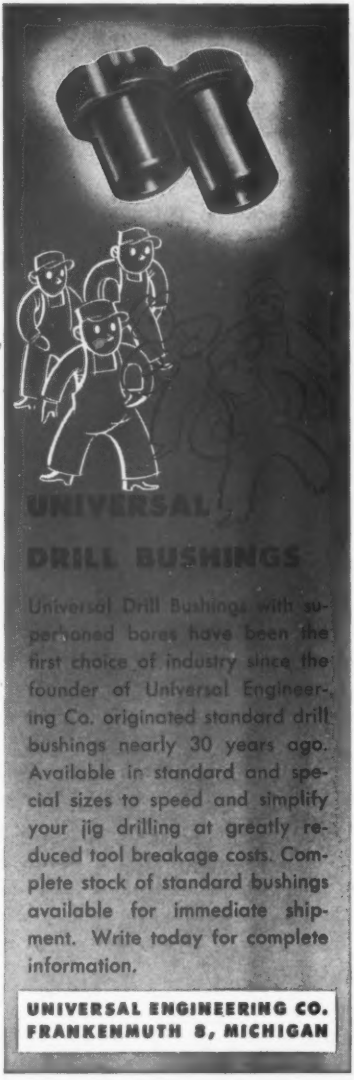
**Carlson's Coiler No. 2** is a new hand-operated spring coiling machine for making rather large compression, extension or torsion springs. It is especially useful for making experimental or sample springs and for short production runs up to about 5000 pieces, as the setup time is usually less than five minutes and the output is up to 300 precision springs per hour. Outside diameters up to 2" and wire diameters from .041" to .156" can be coiled. Address THE CARLSON CO., 277 Broadway, New York 7, N. Y.

**Circle Inform-A-Gram No. A32.**

**Model AP-1 Brinell Hardness Testing Machine** of Steel City incorporates a throat depth of 24". Made especially for a leading producer of armor plate, this hydraulically operated unit is also adaptable by others who need a deep-throated hardness tester. It is mounted on wheels so that it can be rolled out of the way when not in use and then easily rolled into position, reaching out over a conveyor. Maximum vertical opening between ball penetrator and anvil is 4". STEEL CITY TESTING MACHINES, INC., 8843 Livernois, Detroit 4, Mich.



**Circle Inform-A-Gram No. A34.**


UNIVERSAL
DRILL BUSHINGS
Universal Drill Bushings with superfoned bores have been the first choice of industry since the founder of Universal Engineering Co. originated standard drill bushings nearly 30 years ago. Available in standard and special sizes to speed and simplify your jig drilling at greatly reduced tool breakage costs. Complete stock of standard bushings available for immediate shipment. Write today for complete information.
UNIVERSAL ENGINEERING CO.
FRANKENMUTH 8, MICHIGAN

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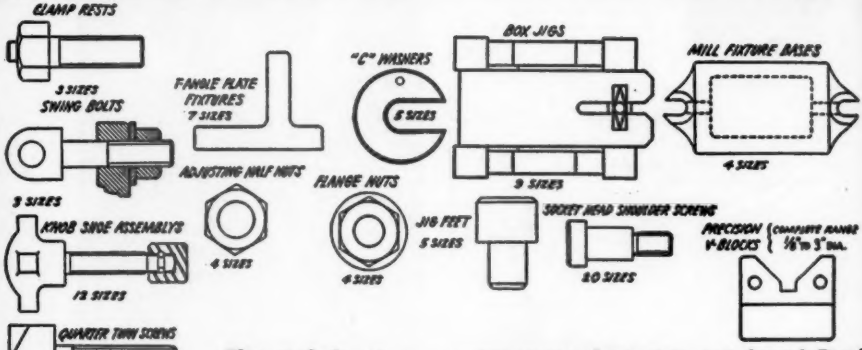
# SAVE MAN-HOURS

OF YOUR DESIGNERS AND TOOLMAKERS!

## USE NOBLE & STANTON STANDARD JIG AND FIXTURE PARTS



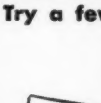

**The rush is on . . . manpower shortages are here! Don't waste the valuable time of your designers and toolmakers in custom-building jig and fixture components.**

**Now is the time to use Noble & Stanton *Standard* Jig and Fixture Parts. Adopt them as standards in your plant. They're the best you can buy—are tough and durable—will never fail on the job—can be used over and over again.**

**Noble & Stanton Components are precision made from quality steels. NS parts are turned from solid stock—not welded or brazed. They're heat treated and hard chrome plated wherever practicable.**

**Write today for full information on the Noble & Stanton line of over 300 parts. They cost less than one-third the cost of toolroom manufacture. Tracing sheets are available for every part—saving you design time. Try a few of the items—or stock the whole line!**

***WRITE FOR CATALOG. Send today for this free 52-page book of drawings, specifications and prices.***



## NOBLE & STANTON, INC.

1002 BROADWAY • BEDFORD, OHIO

INFORM-A-GRAM CARDS—USE THEM FOR PROMPT PRODUCT INFORMATION SERVICE!

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
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| A2 | A16 | A30 | B10 | B24 | B38 | B52 | B66 | B80 | C4 | D9 | E11 | |
| A3 | A17 | A31 | B11 | B25 | B39 | B53 | B67 | B81 | C5 | D10 | E12 | |
| A4 | A18 | A32 | B12 | B26 | B40 | B54 | B68 | B82 | C6 | D11 | E13 | |
| A5 | A19 | A33 | B13 | B27 | B41 | B55 | B69 | B83 | C7 | D12 | E14 | |
| A6 | A20 | A34 | B14 | B28 | B42 | B56 | B70 | B84 | C8 | E1 | E15 | |
| A7 | A21 | B1 | B15 | B29 | B43 | B57 | B71 | B85 | C9 | E2 | E16 | |
| A8 | A22 | B2 | B16 | B30 | B44 | B58 | B72 | B86 | C10 | E3 | E17 | |
| A9 | A23 | B3 | B17 | B31 | B45 | B59 | B73 | B87 | C11 | E4 | E18 | |
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| A14 | A28 | B8 | B22 | B36 | B50 | B64 | B78 | C2 | D7 | E9 | E23 | |

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| 2 | 20 | 37 | 54 | 93 | 115 | 134 | 145D | 154B | 164 | 177 | 191B | 208C | 219C | 228D | 230B |
| 3 | 21 | 38 | 55 | 94 | 116 | 135 | 146A | 154C | 165 | 178A | 191C | 208D | 221A | 228E | 231 |
| 5 | 22 | 39 | 56 | 95 | 117 | 136 | 146B | 154D | 166 | 178B | 191D | 209A | 221B | 228F | 232 |
| 6 | 23 | 40 | 57 | 97 | 119A | 137 | 146C | 155 | 167 | 179 | 191E | 209B | 221C | 228G | |
| 7 | 24 | 41 | 58 | 98 | 119B | 138 | 146D | 156 | 169A | 180A | 192 | 211A | 222 | 228H | |
| 8 | 25 | 42 | 73 | 99 | 122A | 139 | 146E | 157A | 169B | 180B | 193 | 211B | 233A | 228J | |
| 9 | 26 | 43 | 75 | 100 | 122B | 140 | 147 | 157B | 172A | 180C | 195 | 213A | 223B | 228K | |
| 10 | 27 | 44 | 77 | 101 | 123A | 141 | 148A | 157C | 172B | 181 | 197 | 213B | 223C | 228L | |
| 11 | 28 | 45 | 79 | 102 | 123B | 142A | 148B | 157D | 172C | 182 | 199 | 213C | 225A | 228M | |
| 12 | 29 | 46 | 81 | 103 | 125A | 142B | 148C | 158 | 173 | 184 | 201 | 215A | 225B | 228N | |
| 13 | 30 | 47 | 83 | 104 | 125B | 142C | 148D | 159 | 174A | 185 | 203 | 215B | 225C | 228P | |
| 14 | 31 | 48 | 85 | 105 | 129A | 142D | 149 | 160 | 174B | 186 | 205A | 215C | 225D | 228R | |
| 15 | 32 | 49 | 87 | 106 | 129B | 142E | 151A | 161A | 174C | 187 | 205B | 217A | 227A | 228S | |
| 16 | 33 | 50 | 88 | 107 | 130 | 143 | 151B | 161B | 175 | 188 | 206 | 217B | 227B | 229A | |
| 17 | 34 | 51 | 89 | 109 | 131 | 145A | 153A | 161C | 176A | 189 | 207 | 217C | 228A | 229B | |
| 18 | 35 | 52 | 91 | 111 | 132 | 145B | 153B | 162 | 176B | 190 | 208A | 219A | 228B | 229C | |

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used to the extent necessary to verify evidence of quality submitted by the contractor or it may be used to determine acceptability of supplies on an individual or lot basis.

b. The amount of evidence obtained or verified through product inspection by the Air Force Quality Control personnel will depend upon the nature and intended use of the product and the effectiveness of the contractor's control over quality."

Since Specification MIL-Q-5923 looms so large in the AF's Quality Control program, some mention should be made of its background and development. The first objective was to prepare a document sufficiently flexible that it would be suitable for all sizes and types of manufacturing organizations and for most types of supplies procured by the Air Force. The second objective was to state requirements in general terms; to give the "what" while leaving the "how" up to the discretion of the contractor, with the approval of local Air Force Quality Control personnel. At present, MIL-Q-5923 is an uncoordinated MIL specification. It is hoped that at some future date the specification may be adopted in somewhat its present form by the other military services. It was deemed highly desirable to obtain the comments of industry prior to the publication of the specification. Of course, all industries could not be contacted; however, it was felt that the Aircraft Industries Association represented a good section of the Air Force's suppliers. Therefore, the specification was coordinated with AIA. As stated above, the specification is a reflection of basic Air Force Quality Control policy. It stresses the fact that inspection and Quality Control are the responsibilities of the contractor and that the Air Force role is to maintain surveillance over the contractor's system.

The specification is applicable to many of the types of supplies procured by the Air Force. Dollar-wise, it is applicable to a very large percentage of AF

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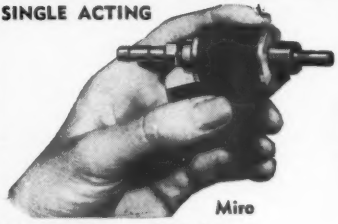

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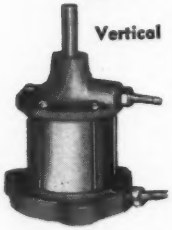

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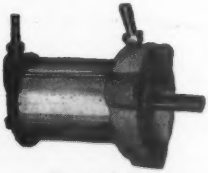

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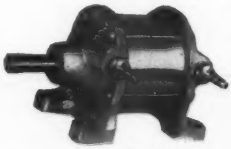

Parallel

procurements. Certain exceptions are listed on the first page of the specification. Typical exceptions are for "off-the-shelf" purchases, and for research and development or experimental articles. It is anticipated that the specification will be made a part of all future contracts to which it is applicable. It may be included in existing contracts by negotiation.

Actually, compliance with Specification MIL-Q-5923 will require very little change in the systems of contractors who currently have Air Force approved Quality Control systems. There are very few new requirements. The specification merely summarizes those requirements which have existed for some time. For the benefit of both those contractors who may not have had Air Force contracts recently and those already doing business with the Air Force, the main provisions of MIL-Q-5923 are outlined below in the order in which they occur in the specification.

The first requirement is that the contractor establish and maintain an efficient and economical Quality Control or inspection system. It is the basic responsibility of the contractor to provide sufficient inspection coverage, from the receipt of raw material to the packing and shipping of the end item, to assure that the supplies meet all contractual requirements. Contractors are required to submit evidence of such conformance prior to submission of the supplies to the Government for acceptance.

The contractor is obligated to prepare a Quality Control Manual which will spell out the general procedures by which he intends to comply with the requirements of the specification. Such a manual should include an organizational chart and a functional plant diagram showing inspection stations. It should include exhibits of inspection operation sheets, forms, and records used in inspection, and a general discussion of their use. Detailed inspection and test procedures may be included in the manual or incorporated by reference to other

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documents. The Air Force approval of the manual must normally be obtained prior to the start of production on the contract.

The contractor's Quality Control system is subject to periodic rating surveys by the Air Force. A survey results in either an approved or disapproved rating, or the rating may be deferred until action has been taken to correct the discrepancies noted. Since the contract requires the contractor to have an approved system, a disapproved rating constitutes a basis for default of contract.

The section on raw material sets forth those circumstances under which test reports are required and makes provisions for the use of certificates in certain cases. There is also a requirement that the contractor provide facilities for withholding raw materials from issue pending verification of the type of material.

Subsequent sections set forth, in general terms, the contractor's responsibility for providing suitable inspection facilities and equipment. The contractor is required to provide such inspection, measuring and testing equipment as is necessary to determine conformance of the supplies to contractual requirements. It is also required that the contractor periodically check such equipment at established intervals. Production tooling used for inspection must also be checked at frequencies determined by the type and use of the tooling. The schedule prepared by the contractor and approved by the Air Force becomes a part of the Quality Control procedure and should be incorporated in the Quality Control Manual. There are further requirements for maintaining control of engineering drawings and changes, such as provisions for assuring that the latest drawings, technical order requirements, and contract change information are available to inspectors.

Considerable space in the specification is devoted to the Materials Review Procedure, which, incidently, is a joint procedure used by both the Air Force and the Bureau of Aeronautics of the Navy. Briefly outlined, this procedure

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requires the identification and preliminary review of all discrepant material to determine whether it shall be scrapped, completed, accepted as is, or submitted for formal Materials Review Board action. Material in the latter category must be segregated from other material. The organization of one or more Materials Review Boards is subject to Air Force approval, but in all cases each board consists of three persons: a member of the contractor's engineering group, a member of the contractor's inspection group, and a representative of the Government Procuring Agency. The duties of the Materials Review Board are to determine disposition of all material submitted for its consideration, to maintain records of all its actions, and, most important, to obtain corrective action to remove the cause of the discrepant material. Acceptance of any material by the Materials Review Board requires the unanimous approval of all members. A further requirement is that the contractor's management, review all materials review records with a view to assuring corrective action.

The specification provides that where acceptance sampling procedures for inspection by attributes are used, these procedures shall be in accordance with MIL-STD-105A, unless the Government waives this requirement. This is not intended to be an arbitrary dictum. Where the contractor can show a valid reason for using some other type of attribute sampling plan, it will normally be approved. This paragraph also requires Government approval of individual sampling plans and inspection standards, such as Classifications of Defects and Acceptable Quality Levels.

Some of the contractor's responsibilities for the care and handling of Government-Furnished Property (GFP) are specified. In general, these deal with receiving inspection by the contractor to detect in-transit damage and the contractor's obligation for reporting Government-Furnished Property which is found to be damaged or defective while in the contractor's plant.

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The section on special processes sets forth the contractor's requirements for obtaining the approval and/or certification of certain operators, and certain types of equipment, such as welding, X-ray, or magnetic inspection. In addition, the prime contractor is made responsible for assuring that his subcontractors are qualified in this respect before they are awarded subcontracts.

One of the most important elements of the contractor's Quality Control system, as viewed by the Air Force, is the maintenance of records. The first requirement is that records list or make reference to all important quality characteristics and indicate those characteristics which do not conform to requirements. When attribute sampling is used, the records should show the Classification of Defects, the lot and sample sizes, the acceptance and rejection numbers, and the number of defects found in each sample. Records should indicate the results and methods used in interchangeability inspections and functional tests. All records should be maintained in such a way as to reflect recurring discrepancies and should indicate corrective action taken. Finally, included in the contractor's inspection records should be individual instructions to the contractor's inspectors. Since the Air Force bases its acceptance not on complete product inspection but rather on surveillance of the contractor's Quality Control system, it is essential that the contractor maintain records which are subject to audit.

The section on subcontracts requires that prime contractors make the applicable provisions of the specification binding on their suppliers and subcontractors. In this connection it is well to point out that Government source inspection of subcontracted material is not a guarantee of final acceptance. Source inspection is performed solely for the benefit of the Air Force Quality Control inspector at the prime contractor's plant, and, since there is not contractual agreement between the Air Force and the subcon-

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tractor, such source inspection can in no way be considered as indicating Air Force approval of the material. In connection with subcontracts, the specification also requires that prime contractors' purchase orders include all applicable data including drawings, specifications, process data, and preservation and packaging requirements. The contractor is required to take corrective action in the case of defective subcontracted items and to report the situation to the Air Force Quality Control inspector at the prime plant when defective material was source inspected by the Government. The requirements, in succeeding paragraphs, pertaining to the design and use of inspection stamps stem from the Air Force policy of minimizing the use of Government stamps, and of recognizing approved contractors' stamps.

An important requirement which hitherto has often been overlooked is that the contractor must assure that qualification tests and approval, if required by the specification, are obtained prior to the submission of the supplies to the Government. In the event such tests or approval have not been obtained, contractual deviation must be requested before acceptance can be made.

The section on statistical process control with those techniques which make it possible to judge the significance of quality variations between successive units of production. If such process controls are used for acceptance purposes, they must have Air Force approval; however, they are not subject to Government review if simply used for manufacturing control. The specification provides that the use of Government-approved controls may reduce, but not eliminate, final inspection.

This paper, of necessity, has been limited to a review, in brief outline form, of the part the contractor plays in the Air Force's Quality Control program. We have mentioned that Government inspection, as a tool of Quality Control, is a legal requirement, and that under

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SEE ADVERTISERS INDEX, PAGE 183, FOR KEY NUMBERS

Air Force Quality Control policy the contractor must maintain adequate inspection controls. The contractor's Quality Control system is subject to the approval and continuing surveillance of the Air Force. We have discussed how two documents, Specification MIL-Q-5923 and DOI 74-1, furnish the respective ground rules for both partners in the Air Force-Industry team. These documents should be thoroughly studied for a more detailed treatment of all the topics mentioned in this review. By equipping ourselves with a detailed knowledge of our mutual obligations, and by achieving a broad perspective of each other's problems, we in industry and in the Air Force can take a long stride toward our common goal, namely — the world's best Air Force at a cost within the capabilities of our national economy.

★ ★ ★ ★

## Top Executives Urged to Orient Employees

More effective use should be made of top executives' personalities, background and accomplishments in winning and holding loyalties of new employees, according to a recent survey by the management consulting firm of Fisher & Rudge, New York.

"Of the 42-well-known companies which figured in our survey," said Austin M. Fisher, partner in the firm," . . . less than half formally introduce new workers to the executives with whom they will have contact in their work.

"Executive participation in such programs is important, not only because it arouses interest and enthusiasm on the part of the recruits, but also because it helps keep the effort on a continuing high plane."

While most of the executives reporting indicated satisfaction with the way their orientation programs are developing, 15 of the 42 admitted they had no formalized plan.

"Where formal plans are lacking," the labor relations expert pointed out, "top management tends to take for granted that 'something is being done' with new employees. The danger under such conditions is that circumstances rather than some regularized procedure will dictate what happens to new employees."

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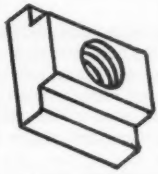

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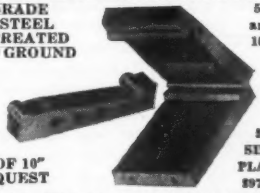

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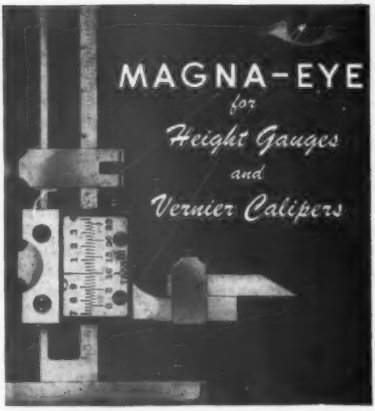


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SEE ADVERTISERS INDEX, PAGE 183, FOR KEY NUMBERS

. . . Thompson Training, from page 118

any sampling scheme under which Thompson products are tested by the customers. Without such skill, the organization might become an easy victim of either wrongly designed or arbitrarily decreed sampling schemes by which incoming material is sampled. To avoid such a possibility, Thompson sales engineers are also given basic training in acceptance sampling.

In the intensive course, all sampling schemes are presented and tested by extensive experimentation. Furthermore, formulas for such concepts as A.Q.L., A.O.Q.L. consumer's and producer's risks, lot tolerance fraction defective, minimum amount of inspection, etc., are derived and practice in their computation is given. In this manner, whatever printed tables are used become more than a mere routine tool; the personnel using them senses the statistics and logic on which they are based.

### Routine Practice

In the short course, the same principles of statistical method are imparted, although chiefly on the empirical basis. Greater emphasis is placed on routine practice, although the larger aspect of the method is constantly brought into the picture through the medium of the sampling machine and through both deductive and inductive logic.

No attempt was made to present the outline of the course; rather, it was to present a partial view of the approach to the subject. The soundness of that approach is tested at the end of each course when the students are asked to fill out a questionaire pertaining to the efficiency of the class presentation, to the selection of material, to the proportion between the theoretical and practical considerations, etc. In that way, the instructor learns to improve the presentation of the course.

### Thompson Quality Control Activities

Thompson Products has often shared the skill of its personnel with the larger Cleveland community. For the last two years, the Tapco quality control engineer has taught statistical quality con-

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trol in the Technical Institute of Fenn College. For the last four years, the Thompson staff statistician has been giving undergraduate and graduate instruction in statistical quality control at Western Reserve University. Although in the former he uses printed text for collateral reading, the course itself is that developed and tested at Tapco. As the quality control program at Thompson is now well established and in competent hands, the instructor finds time to combine the best results of his past teaching and the most valuable constructive suggestions offered by the several hundreds of his Thompson and university students into a textbook.

It is hoped the distinguishing feature of the text will be the unified philosophy of the subject and the tremendous amount of original research applied to the data collected, analyzed, and charted at Thompson. All charts perviously used in the course are now redrawn to more appropriate or readily comparable scales and to uniform size; tables and charts are cross-referenced, and various other media are used to make the test of practical use to shop personnel as well as to students with previous statistical training.

Thompson men trained in quality control have contributed to the development of the Ohio section of the American Society for Quality Control by participating in committees, by giving lectures, and by augmenting its membership. For example, in 1949, of the 242 section members, 82 were Thompson men who paid the dues out of their own pocket. Since such membership includes a subscription to the "Industrial Quality Control" magazine, Thompson quality control personnel are in close touch with the current developments of the technique recorded in that publication. They are constantly encouraged to seek knowledge from any reliable source; at the same time, they are taught to exercise critical judgment through sound teaching in statistical method and inference. The successful and extensive development of the program described in this report justifies the belief that a quality control program developed cooperatively by everyone concerned is a sound one.

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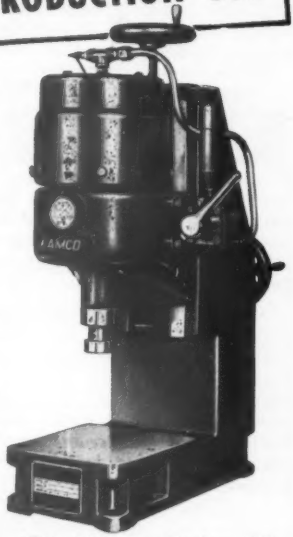
*For further details, write for new Famco Air Press Catalog.*

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SEE ADVERTISERS INDEX, PAGE 183, FOR KEY NUMBERS

. . . Bearing Down, from page 61

product was almost completely finished. But we felt that if the statistical methods would be able to help us at the start of our production line, it should be able to help us at any other point in the line.

Upon the original inspection arrangement, we superimposed an average and range chart and assigned roving inspectors to gather the data required by such charts. The charts were carefully reviewed daily by the manufacturing department head and the departmental inspection foreman. The charts indicated that the machines were capable of maintaining the required tolerances and they also showed that the machines were being adjusted by the operators. A machine adjustment was called for by the inspector whenever she thought the machine required it. The machine operator, desiring to have her output passed by the inspector, made the requested adjustment. Only when the operator failed to correctly adjust the machine was the job-setter notified.

While checking back on the necessity for the adjustment by the operators, it was discovered that the setup practices followed by the job-setters permitted the machines to produce the product to a variation of 100% beyond blueprint specifications. The setup practice in question was that of leaving certain important bolts loose so that the operators could make their own adjustment whenever it was requested.

### Job-Setters & Adjustments

It was pointed out to the job-setters that the machine operators were not sufficiently schooled to know how much adjustment was made when certain bolts were turned, and that the principal difficulty was with frequent adjustments. The job-setters were instructed to tighten all bolts in a setup and to make all necessary adjustments.

They made dire and foreboding remarks about the expected quality deterioration. They also announced that it would be physically impossible for them to keep abreast of the necessary adjustments and they requested the assignment of another man to the machine center. This request was honored, and after four days of having three men service sixteen machines, the third man voluntarily asked to be relieved because his hardest job was to try and look busy when he had nothing to do.

The continued use of chart control after these changes showed a slow but steady improvement. Prior to the use of control charts, the percent defective due to this machining operation alone was greater than ten percent, and after to years of application, the percent defective has settled to 1.5%.

### Cooperation, Plus and Minus

Our initial installation was not made without discouragement and veiled lack of cooperation. It was at this first application that we discovered the lengths to which some people would go in order to resist the introduction of methods and procedures which they did not fully comprehend.

It appeared that the people who would benefit the most from the charting practices were the ones who seemed to spend hours in devising ways and means of terminating this experimental application of chart control. We realized before we started that to introduce quality control methods by edict would limit the usefulness of the procedure, therefore we took the discouragements with as good a grace as we could muster and went back for more the next day.

The attitudes of the men varied from passive to openly hostile despite our efforts to sell the idea of chart control. The men in that first section have now accepted the procedures although they are still a little reserved.

### Rotary Chamfer Charting

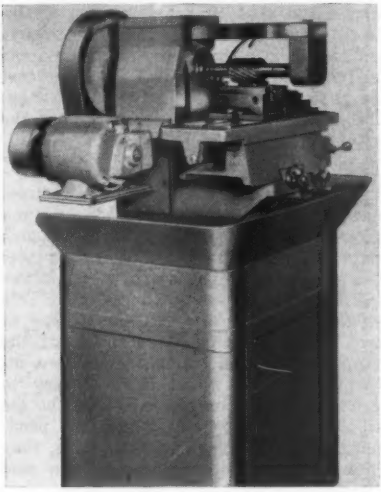
The success of our initial installation led to the incorporating of charting practices at a rotary chamfer machine center where everyone was convinced that the machines were not capable of holding size because of their age and design.

A blueprint revision on tolerances was under serious consideration at the time the manufacturing department head had requested the starting of charting procedures. The average and range chart was put into use at the machine center

*(Continued on page 196)*

## "Speed-Milling" of Small Parts

The Viking No. 618 Hydraulic-Mill is a new, light production milling machine for fast milling of small parts requiring close limits and fine finishes. It features an automatic milling cycle, hydraulic feeds, small amount of floor space and maximum rigidity for cuts, using rotary cutters up to 6" diameter.



This machine cycles within a range of 10 seconds to 18 minutes, including full table travel. Cycle time varies according to size of cut and length of travel. Hydraulic feed through valve selection is infinite from ⅜" to 24" per minute, over a 7" maximum length of cut. A separate ¾ hp motor assures positive steady power to the spindle. A standard type ½ hp motor drives the hydraulic motor and coolant pump off the same shaft. The coolant system is supplied from an 8-gallon coolant reservoir.

Complete details and literature can be obtained by writing the manufacturer, VIKING INDUSTRIES, Dept D, 220 Montague St., Rockford Ill.
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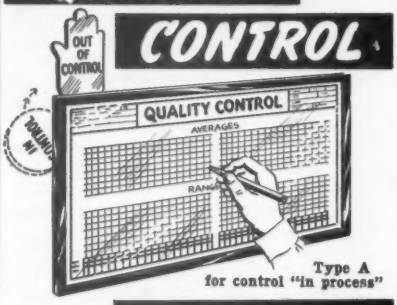
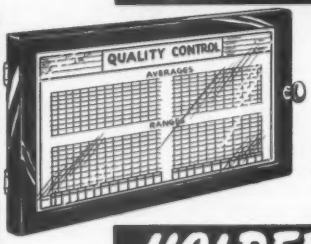



Type A for control "in process"

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SEE ADVERTISERS INDEX, PAGE 183, FOR KEY NUMBERS

. . . Bearing Down, from page 194
and the charts were reviewed daily. The accumulation of data with the charts established the fact that the machines were basically capable of maintaining the blueprint tolerances.

The practice had been to set the tolerances in the machine to cut to the low limit and to anticipate that the size of the products would gradually approach the high limit as the tools would wear. However, the inspectors were instructed to note, during the chart procedures, whenever adjustments were made.

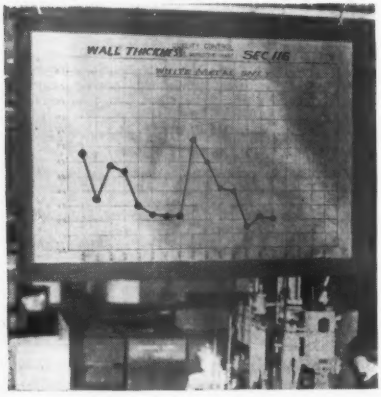
Their records showed that the tools were changed or adjusted oftener and sooner than called for by tool wear.

Broken and burned-out tools were replaced long before a definite trend in tool wear would show up, therefore it became a problem of educating job-setters and operators to set the machine on the blueprint mean before it was started on a production run.

### Declining % Defective

The percent defective at the rotary chamfer center prior to charting was higher than 5%. After charting practices were started the percent defective dropped slowly. At the end of the first year it had dropped to 1.2%. After two years it dropped to .7%. The charting practice was discontinued and the percent defective has fluctuated very little from the last figure of .7%.

**Fig. 2. Large scale percent defective charts hung over each machining center show employees and visitors how each dimension is holding.**




An interesting sidelight on charting appeared at one of our branch plants. The percent defective chart at their rotary chamfer machine center showed a steady decline and then the usual leveling off followed. The plant manager was advised that he could discontinue the charting practices at this center if he desired. He issued instructions to stop the charting. The job-setters in that center raised immediate objections and asked that the charting be continued. They told him that the charts guided them in the timing of adjustments and replacement of tools. Since the cost of charting at this operation was negligible, the plant manager permitted the reinstatement of charting.

### Tool Wear Allowance

The data gathered on the charts used each machining center provided many bits of useful information. Among such data was the discovery that the tool design department was arbitrarily allowing for tool wear in our notch dies. This wear factor was the addition of one or two thousandths on the location of the notch in the die. When they were informed that it would be necessary to run several million pieces before the die would wear enough to permit the product to meet blueprint specifications, they immediately stopped the practice and corrected the existing tools.

To stimulate the interest of the machine operators and job-setters, we constructed large frames 2′ x 3′ in size and we hung one over each machining center, Figure 2. Into these frames we placed large percent defective charts which showed everyone, employee and visitor alike, how well each center was meeting the blueprint specification.

The data for the charts were gathered by taking random samples from the production line and measuring them for deviations from specific dimensions.

### Usable vs. Defective

The percent defective chart was the most difficult to "sell." This was because the slightest deviation from blueprint specifications was reported as a defective.

*(Continued on page 198)*

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SEE ADVERTISERS INDEX, PAGE 183, FOR KEY NUMBERS

. . . Bearing Down, from page 196

The practical shop man refused to see why the product was reported as a defective if it was usable. We had to start from the solid foundation of blueprint specification if we were to make progress in improving our quality level.

We were induced by the steady improvement brought about by manufacturing chart control applications, in the engine crankshaft bearing line, to use the same types of application in the bushing department.

The bushing department manufactures bush-type bearings for the automotive, farm implement and appliance industries from flat strip material of our own fabrication.

### Q-C in the Bushing Department

The production personnel in this department were clamoring for better strip material. They claimed that their difficulty to maintain blueprint specifications on outside diameter stemmed from the fact that the raw strip was at times beyond the intermediate manufacturing blueprint specifications. We might have been taken in by their claims if they had not repeatedly insisted that they had reached the end of their rope improvement-wise.

### Bushing Inspection

The method of inspecting split bushings for many years had been to put the bushings into go-no-go ring gages with the specifications that the bushings were to be a hand push fit into the go ring, and that they should not enter the no-go ring. This method of inspection had much of the human element because different people could, by varying hand pressures, raise dissension as to the actual size of a given part. This difficulty prevented the immediate use of control charts. However, it served to point up the urgent need for an inspection instrument which would eliminate the human element as far as possible.

The split block gage, Figure 3, was evolved and it eliminated the use of ring gages and it also terminated the effect of the human element. It demonstrated further that we had interpreted the phrase "go and no-go" too literally.

**Fig. 3. This split block gage eliminated the human variable in go-no-go ring manipulation with resultant opening up of tolerances.**

The gage, by the removal of the human element, permitted the apparent opening up of the tolerances and gave us the required instrument for the use of average and range charts.

### Charts Disclose Contradictions

The initial charts gave some credence to the claims that better strip would eliminate their difficulties, but the continued use of charting began to show up contradictions. It was decided to use the methods of correlation analysis to solve the difficulties. The results of correlation studies were the same as those obtained from the charts. The early data verified the departmental claims but continued study began to show inconsistencies by producing statisically insignificant correlation factors.

The contradictory results of the correlation study, coupled with the results of control charts, told us that many other factors could be confounding our efforts to solve the problem of variation in O.D. size.

The remaining approach to the solution of the problem was the use of statistically designed experiments which included the variable factors responsible for the divergent results.

The conclusions from the experimental work were that the variation in the strip did measurably contribute to the diffi-

*(Continued on page 206)*

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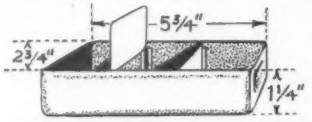


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. . . Profitable Quality, from page 65

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| | See Print | |
| A | .1595 - .002 Diameter | G# 16562 |
| A | .129 - .002 " | G# 9603-177 |
| A | .089 & .1595 Dias. concentric within .002 T.I.R. | G# 16563 |
| A | Parts must be clean & free from cracks | Visual |
| | | |
| B | .089 - .006 Diameter | G# 9603-120 |
| B | .406 - .005 Length | Micrometers |
| B | .015 ± .001 Thickness | G# 15748 |
| B | .010 Max. Radius | Projector |
| | | |
| C | .008 - .003 X 45° ± 5° Chamfer | Projector |

FIG. 1

it necessary to conduct one hundred per cent inspection at the end of this sub-assembly line. The average level of 4 per cent rejects dictated such action. If these sub-assembly rejects were permitted to flow on thru to the next control point the cost of reoperation and scrap would exceed the labor cost of screening inspection. Quality Control was able to reduce the reject level from 4 per cent to .7 per cent. At the latter level, inspection at the end of the sub-assembly line was not justified and thus could be eliminated. This meant a reduction in manufacturing cost of $21,500.00 per year.

From August, 1947 to December, 1948 Quality Control was able to bring a reduction in manufacturing cost amounting to $88,000.00. The methods used were basically the same in all cases. The value of quality control had been proved and thus established as a necessary function of the company.

By this time we had also learned that inspection record data are useless unless they are used to analyze quality and manufacturing losses. We also had learned that it was not the control chart nor the sampling procedure that did the job, but the action taken when things were not right that produced results. The quality control techniques employed provided the alarm system and told us when to go into action. It was up to us to put the fire out.

We now have 90 per cent of all operations covered by quality control. We have increased our quality control staff to eight people but cover two plants instead of one. We have a production force of 1100 and an inspection department of 230 employees. The ratio of inspection to production may seem high to those not familiar with the nature of our products. A good portion of the present inspection force is assigned to war contracts of extremely complex and precise character. Without the use of quality control the inspection department would have to be increased to 350 people in order to do a comparable job of controlling quality.

The core of all inspection activity is the quality control layout shown in Figure 1. By means of this form, Quality Control is able to classify all specifications into various degrees of intensity as to the specifications relationship in the control of quality. The methods of measurement are assigned in the right hand column. Quality levels are assigned to the various A, B, and C catagories. This completed layout is attached to the engineering drawing and is placed on each job throughout the plant. Quality Control drafts this lay-

*(Continued on page 204)*

Superior builds "Tailor-Made" die sets of any size . . . for any purpose. This large 3-pin flat gang bolster (128" long, 21" deep), recently built and machined complete for one of the nation's leading manufacturers.

# SUPERIOR All-Steel DIE SETS!

## BETTER Because

- **Made To Order, To Your Specifications With Utmost Speed and Low Cost**
- **Made With Exclusive Features That Speed Up Handling, Promote Safety**

Superior All-Steel Die Sets give *Better*, all-around *Service, Satisfaction, Performance* because every set, large or small, is built to meet the exact specifications of the die for which it is intended.

In addition, Superior All-Steel Die Sets incorporate many features found on no other set . . . features such as the *Safety Flange* and *Lock Jaw Lifting Device* which permit movement of any type, in any direction with a maximum of ease, speed and safety.

You Can't Go Wrong On SUPERIOR DIE SETS . . . SUPERIOR In the True Sense of the Word.

**FREE CATALOG** available to those interested in securing a detailed description of Superior All-Steel Die Sets. It's information you won't want to miss. Write and ask for your copy of Catalog No. 111, Today.

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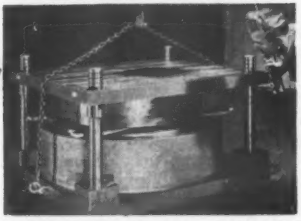
Exclusive Superior "Lock-Jaw" with locking key inserts in slots of Safety Flange . . . ready for any type movement or manipulation.

Exclusive Superior Safety and Lifting Device assures safer and speedier handling of die sets of any size.



Exclusive combination of Safety Flange and Lock-Jaw permits turning die set over without need for clamping . . . physical strength of approximately 135,000 lbs. per sq. in.

**SUPERIOR STEEL PRODUCTS CORP.**
**2754 South 19th St., Milwaukee 7, Wisconsin**

SEE ADVERTISERS INDEX, PAGE 183, FOR KEY NUMBERS

. . . Photography, from page 84

edges on their selected material were cut very clean. In their curiosity they wished to see how much thicker the material could be, and, also, how many sheets of the first-chosen thickness could be cut simultaneously. It was observed that the single sheet could be increased in thickness fifty percent without damage to the tool or the cleanness of the cut. If, however, three sheets of the initial thickness were used they could be all cut clean. There is no logical answer for this.

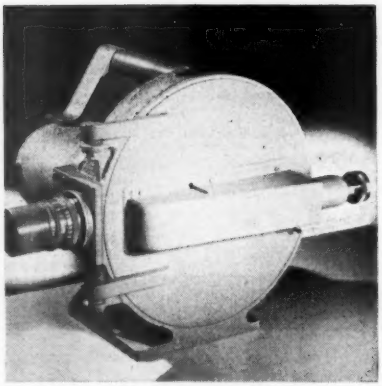
At the Instrument Society show it was interesting to note that practically every valve manufacturer who was exhibiting came around to discuss how high speed photography could be used in the study of valves. It has been observed over a period of years that springs, for example, are notoriously wicked in their performance as disclosed by high speed photography. Furthering this study, Figure 2 shows a Fastax camera analyzing the operating characteristics of a spring-winding machine.

In studying the above machine operations the question then arises: How does one take high speed motion pictures? It has been found that high speed motion pictures are being made by engineers who have had no previous training in high speed photography, or photography. Photographic workers ordinarily think in terms of very soft light, but when one begins to take pictures at rates up to 14,000 per second the lighting problem becomes a little more critical.

The engineer, seemingly, will grasp a new art far more rapidly than those who are trained in an associated art. Engineers with one-half hour's instruction can easily make high speed pictures, because cameras today are designed to permit the operator to observe exactly the picture which he is going to take. The control equipment and available lights permit easy operation.

Dr. Harold Edgerton, of Massachusetts Institute of Technology, created a scientific stir in 1932 when he developed a high speed flash tube which would take pictures at about one hundred micro seconds. (One micro second is one millionth of a second.) In his early studies

*(Continued on page 210)*



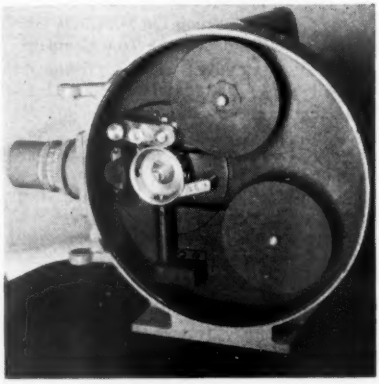


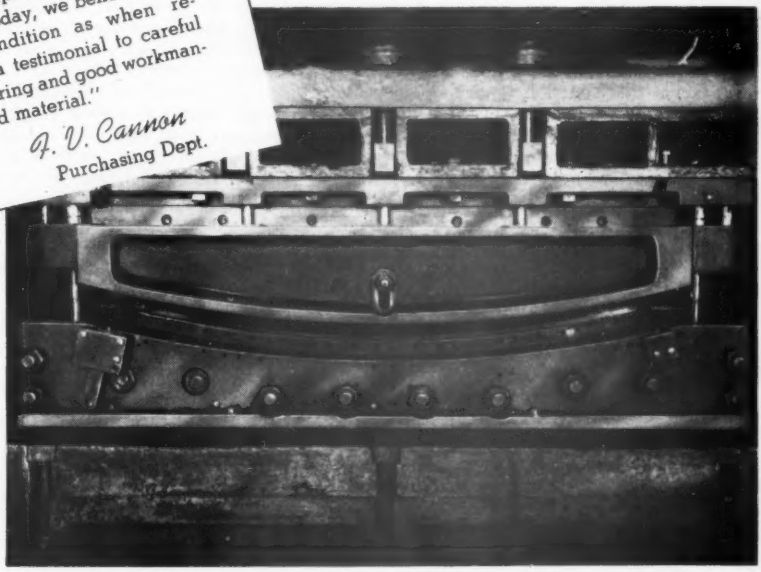
**Fig. 3. (Above) One of the new Wollensak Fastax high speed cameras. They are capable of taking pictures at rates up to 14,000 per second depending upon the model, and size of film. The telescopic view finder gives an accurate, film-size image of the object being studied. (Below) The camera interior. For arresting high speed motion, the film travels fast and with no intermittent or "stop motion." To record the image on the film, in as much as the film doesn't stop, the image has to be "set in motion" at the same rate and direction as the film travel. This is accomplished by a rotating "compensating" prism interposed in the image-light path between the lens and the film. For a fraction of each revolution of the light-transmitting prism the image is directed onto the film surface at a speed (angular) and direction equal to the film travel around the sprocket. Hence with no relative movement between image and film there occurs a sharply focussed exposure of a few micro-seconds duration.**

THE PARKERSBURG RIG AND REEL CO.
PARKERSBURG WEST VIRGINIA
MADE IN U.S.A.

# A TESTIMONIAL TO CAREFUL DIE ENGINEERING!

"The Barth dies have been used almost continuously and have given exceptionally fine service, and are today, we believe, in as good condition as when received; a testimonial to careful engineering and good workmanship and material."

*F. V. Cannon*
Purchasing Dept.



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## THIS FLANGING DIE is 12 YEARS' YOUNG,

having been designed and built in 1939, the first of several steel tank sheet flanging dies built by Barth for the Parkersburg Rig & Reel Co., and, quoting their Mr. Cannon, "Are today, we believe, in as good condition as when received."

Need more proof that Barth Dies are an investment in long life and precision performance . . . that it is better to buy a Barth Die than to wish you had . . . that a customer for Barth Dies is an enthusiastic, repeat customer?

**CALL IN BARTH ON YOUR DIE, TOOLING, SPECIAL MACHINERY AND STAMPING NEEDS**

ARTH'S NEW PLANT

# BARTH STAMPING & MACHINE WORKS, Inc.

*12650 Brookpark Road, Cleveland 29, Ohio*

DESIGNERS AND BUILDERS OF DIES, TOOLS AND SPECIAL MACHINERY

. . . Profitable Quality, from page 200
out and submits it to engineering for approval prior to release.

The quality control layout is a guide to the inspector. It assures proper inspection coverage and standardizes quality measuring methods. Classifying of specifications had always been done by Inspection in their attempts to sort out the necessary and most critical elements of the job. We feel it is much more productive to have qualified engineers perform this function than shop inspectors who may be unaware of the liberties they take with design intent and function.

Predetermination of measuring methods assures proper measuring technique correlated with design needs. A snap gage will not be used to control the diameter of a centerless-ground shaft when an air gage is really needed. Also, the procurement of an expensive gage to control an insignificant specification relative to quality is less likely to be undertaken. Further, the critical specification is not likely to have to be measured by poorly designed and useless gages.

The quality control layout is of great value to vendors. It enables them to properly inspect the product, to duplicate gaging methods, and to properly weigh specifications from the very first pieces produced. This reduces rejections, improves quality, and reduces cost.

For the most part, acceptable quality levels have been standardized. Critical specifications carry a level of 2.5 per cent, semi-critical a level of 6.5 per cent and non-critical, or incidental, a level of 10 per cent. In special cases a further group is used and referred to as "special." Its level will range between .5 and 1.5 per cent depending on the particular quality requirements.

All purchased material must pass quality control acceptance sampling procedures as applied by our receiving inspection. Sampling procedures contained in the Military Standard Mil-105-A are the quality control technique used. We find the multiple sampling tables most

(Continued on page 212)

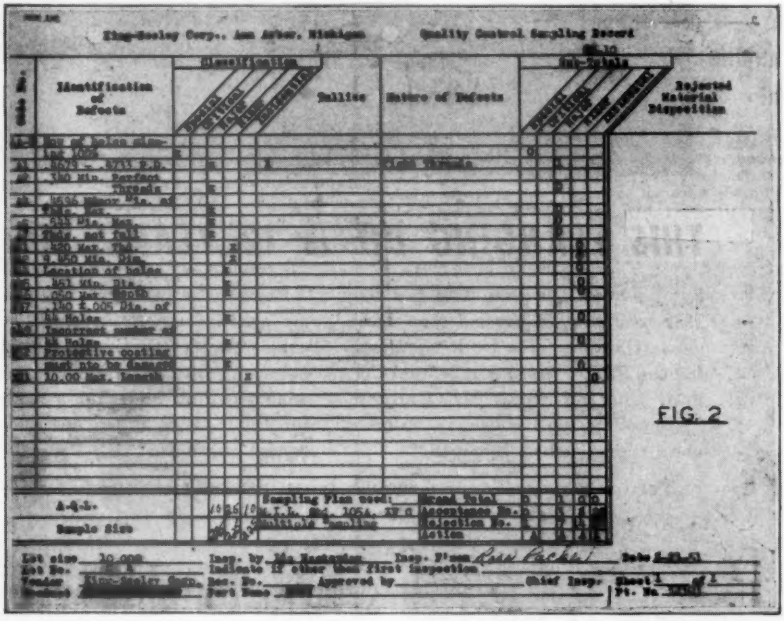


FIG. 2

# The internal gage that's RIGHT for war production conditions

## COMTORPLUG

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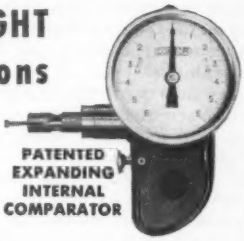


PATENTED EXPANDING INTERNAL COMPARATOR

**⅛" to 8" dia.**

War production conditions intensify the need for a gage that gives high precision yet is Rugged, Automatically Accurate, "Unrestricted".

Patented COMTORPLUG answers the need as no other gage can because:

1) Withstands typical shop use at machine or inspection bench, without lessening precision.
2) Trainees equal old hands in precision results, due to automatic alignment and "feel".
3) For Quality Control, gives actual measurement, and a fixed—not passing—reading.
4) Available anywhere instantly. Weighs but a few ounces. No hose, wire, or "10-ton base".
5) Cost is so reasonable as to be practical for all quantity gaging applications. Fits in with other gaging methods. Let it grow as it proves itself—which it WILL!

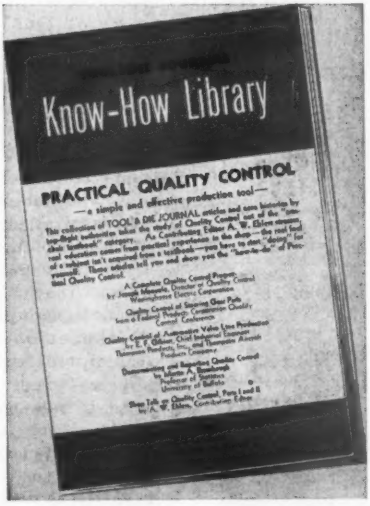
*Inspection to fractional ten-thousandths of hydramatic airplane propeller distributor valve.*

**COMTOR CO.** *Request "Bulletin 40"*

**82 Farwell St., Waltham 64, Mass.**

**For data on COMTORGAGE Precision External Gage, request Bulletin 30.**






# PRACTICAL QUALITY CONTROL

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## HUEBNER PUBLICATIONS

**1975 Lee Road**
**Cleveland 18, Ohio**

. . . Bearing Down, from page 198
culties encountered but that proper set-up practices and tooling would help minimize the variation in the O.D. size of the bushings.

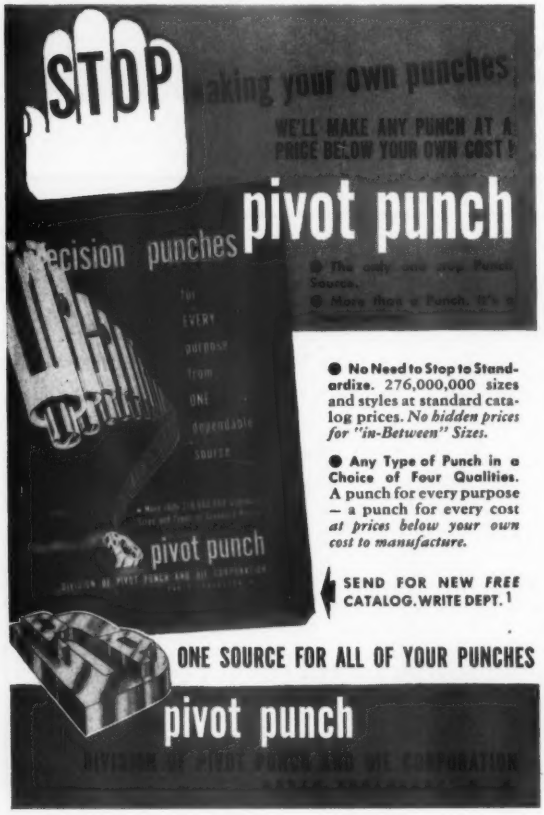
The advent of charting practices into each machining center introduced new problems and new assignable causes which had to be ferreted out. Anyone who has worked with control charts knows that the hardest part of bringing a process under control is the location and elimination of assignable causes.

### Varying Ideas of Variables

Probably the best way to get a complete picture of all the possible causes of variation is to talk to the operators or job-setters at a particular machining center.

We have found that each one has a different idea of the cause of variation. These causes can then be listed in the probable order of importance and checked out by running controlled experiments to determine their various effects.

As more and more of our people became acquainted with charting practices and the stories told by the charts, there was a demand for more information. To meet this demand, we printed a series of articles in our company paper which explained Quality Control in simplified terms. The series covered the making and interpretation of a frequency distribution, how to chart, chart interpretation, and sampling inspection.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### Formal Study Sessions

Our supervisors and foremen were given a twenty-four hour course on all phases of Quality Control. Attendance at all sessions was required since the course was given on company time.

The spread of manufacturing chart control throughout our organization has not been smooth, and we did not expect it to be. The unique organizational place of inspection has certainly made our progress easier because it was never necessary for some member of top management to "lay down the law." We prefer to look up on our difficulties as

miscues by our team when they were called upon to suddenly change work habits of many years' standing.

We are succeeding in achieving our goal of improved quality. Every "p" chart in the machining sections shows a slow decline in percent defective. Complaints from our customers have declined corresponding to the general quality improvement.

**Quality vs. Savings**

We have made some savings in money due to the charting practices. How much was saved in actual dollars we do not know since we did not keep an account of it.

The savings came about as we improved our inspection system, reduced the amount of rejected material, and increased the production time of our machines. We have accepted these savings which came about by the use of statistical quality control methods, although we were willing to pay our money to really improve the quality of our products.

As a direct result of the sagacious approach used by our top management to introduce Quality Control, we have a sound and very strong program in operation.

Our foremen, supervisors and operators now recognize the fact that the prevention of defectives is their active part in Quality Control.

## Turchan Dual Follower

A dual-turning follower has been designed by Turchan Follower Machine Co. with an entirely new combination of movements.

A cross slide, equipped with two compounds mounted at 45° to center line of any standard lathe and 90° to each other, replaces the conventional arrangement. With the new arrangement, the tool approach to the work has twice the means that normally exists.

Parts with contours on the diameter or face can be duplicated, as can combination of both, if desired.

A bulletin illustrating various applications can be had from TURCHAN FOLLOWER MACHINE CO., 8259 Livernois Ave., Detroit 4, Mich.

**Circle Inform-A-Gram No. D12.**


BRINELL TESTING

AT PRODUCTION LINE SPEEDS

Simply set tolerance hands on the lower dial of this Brinell Hardness Tester to the desired limits and the operator merely notes that the indicator points stop within them.

No grinding or preparation of parts is necessary. Foot operation permits free use of both hands. Tests are completed as rapidly as the operator can handle the parts.

Standard Brinell test loads are used . . . machine is motor-driven . . . loads are applied hydraulically . . . round and flat parts are handled equally well . . .

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SEE ADVERTISERS INDEX, PAGE 183, FOR KEY NUMBERS

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Known the world over for fine accuracy. Hand fitted vernier assures smooth, snug operation. COMPLETELY GUARANTEED. Supplied in ENGLISH or ENGLISH and METRIC Graduations. Furnished in handsome form fitting wooden case.

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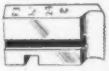

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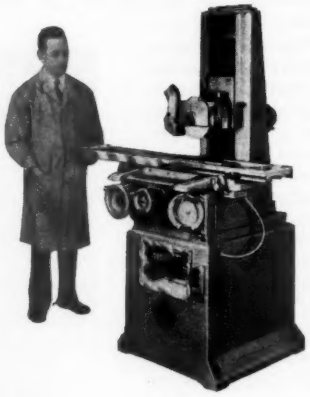

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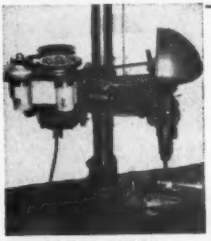
WITH VARIABLE TABLE SPEED - 12 to 35 Feet Per Minute

REID BROTHERS COMPANY INC
BEVERLY MASSACHUSETTS



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**FOR DRILL PRESSES**

- Allows drill head to move freely up and down.
- Speed changes take less than a minute.
- Fits almost any standard motor base up to ¾ HP.
- Reduces spindle speed from 1725 RPM to as low as 100 RPM.

Easy to install, the Newman Speed Reducer is a multiple-speed attachment which is valuable, wherever drilling, tapping, and reaming are done.

**LOUIS NEWMAN MACHINERY COMPANY**

8-10 STEARNS SQ. • SPRINGFIELD, MASS.

. . . Ford, from page 108

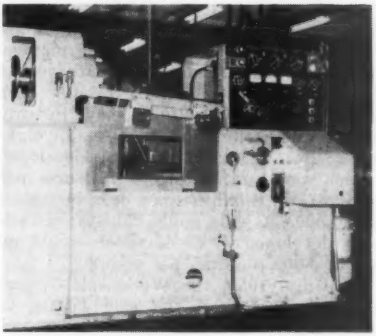

**Fig. 8. A test stand developed to check and indicate the performance of a completed automatic transmission assembly under simulated driving conditions. As well as electronic circuits, the stand has mechanical and hydraulic elements.**

challenges have already been met and overcome by the Ford Motor Company.

In the first instance, minute studies were made to determine the potential maximum efficiency of our manufacturing processes, upon which our research and development program has been predicated. Later, when the most appropriate gages had been selected and developed, a permanent gage display was established whereby representatives of any company division can study the gages, discuss their specific problems with experts, and be aided in their selection. At Ford we call this "Indicating the way to Quality!"

**Fig. 9. This mobile indicating equipment was designed to test body assemblies for air leakage.**

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. . . Photography, from page 202

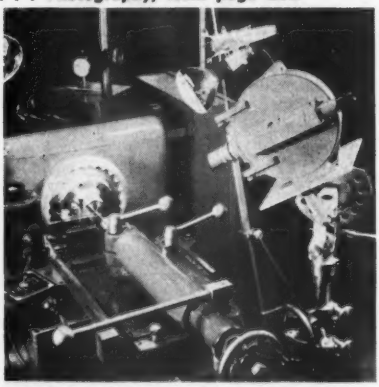

*Fig. 4. A Fastax camera set up to record an accurate thread cutting job on a Hardinge precision lathe. The film will show the action of the thread-cutting tool as it cuts the V bottom. It will disclose unsuspected chatter and will "time-magnify" any tearing of the material due to a poorly prepared tool point.*

he would take individual pictures, and later repetitive pictures on a single plate or film. With a known duration of light, it was easy to calculate the velocity of the motion being studied.

This technique was then developed into motion pictures by flashing the light from a commutator on a motor shaft which was driving film continuously. The light flash was synchronized with the film speed so as to produce a thirty-five millimeter standard frame motion picture. The picture taking rates which were possible were up to 1,500 per second. If one were willing to sacrifice the true motion picture frame size, and go to a more ribbon-like picture, it was possible, by using multiple units, to secure speeds of picture taking up to 20,000 per second.

Shortly thereafter, the Eastman Kodak Company, and Electrical Research Products, Inc., presented a rotating prism camera which would permit picture taking rates of 1,500 to 2,000 per second. With the picture being exposed on sixteen millimeter frame there was simultaneously photographed a clock so that time measurements could be made of the event as it was occurring.

In 1934 the Fastex high speed motion picture camera was developed at Bell Telephone Laboratories with a spectrum from 150 to 4,000 per second. With improvements over the years, this picture-taking spectrum has been increased to 7,000 pictures per second through high speed photographic studies made in turn, on the older cameras. In 1941 an eight millimeter Fastax camera was developed which would go up to 8,000 pictures per second, and this has since been increased to 14,000. A wide angle ballistic camera was developed in 1944, which would go up to 5,000 pictures per second.

In July, 1950, the Wollensak Optical Company acquired the sole rights to Fastex cameras which had been developed by Bell Telephone Laboratories and manufactured by the Western Electric Company. It was found that there had been many defects in the Western Electric cameras, namely, ninety-five percent of them were out of focus. The Wollensak Optical Company is correcting these cameras and modifying the older cameras to bring them into shape as part of their progressive policy.

The new Fastex high speed camera is shown in Figure 3, and Figures 4 and 5 show the camera photographing a lathe and a Swiss automatic. It can be observed that the equipment which is used with the camera is simple.

The prime purpose of high speed photography is to magnify time. If an action takes place in one-tenth of a second, it is too fast for a normal visual observation. However, if that action is multiplied 417 times, such as it would be with a sixteen millimeter camera taking pictures at nearly 7,000 per second, that action then takes place in 41.7 seconds when projected on the screen at normal rate. Then what is happening during this "magnified" time can be easily noted. It takes sixteen and a half feet of film to study the burning of a photoflash lamp, a phenomena which normally is seemingly instantaneous.

Obviously, with intermittent shutters having a top speed of 256 per second, it is necessary to resort to continuous film motion with rotary shutter action and synchronized image to acquire results.

*(Continued on page 214)*

**NEW PORTMAN "century"**

Latest accomplishment of a progressive producer with long, broad experience in micro-projection optics . . .

**FEATURING:**

1) "Super-Light" condenser lens, power cooled.
2) Portman "Ciptar-Scope" precision optical system provides maximum illumination with sharpest definition . . . for large optical capacity.
3) Focal length average in excess of 3 inches.
4) Magnifications: 10x, 20x, 25x, 31¼x, 50x, 62½x and 100x are standard.
5) Large 16-inch diameter "Sight-Line" screen.
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7) Rugged chassis assures permanent alignment.
8) Price: Only $885.00 complete with choice of one lens.

*The Portman "Century" is the ideal optical comparator for the tool room, for gage inspection and for production shop work. Write or wire for details.*

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**OPTICAL COMPARATOR**

*Vertical Model C-100*

**PORTMAN INSTRUMENT COMPANY**

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**CUT BORING COSTS**

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- Attaches to Bridgeport in one minute
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☐ ..... Acro-Bore Boring Units, check, money order, COD or open account.

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STREET .....

CITY ..... ZONE ..... STATE .....


SEE ADVERTISERS INDEX, PAGE 183, FOR KEY NUMBERS

. . . Profitable Quality, from page 204

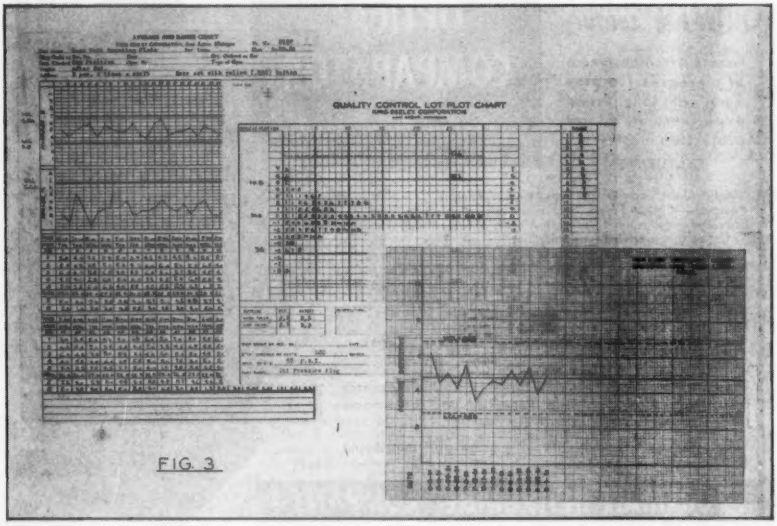


FIG. 3

economical to use but sometimes we resort to single sampling when the size of the lot is small. Figure 2 illustrates the type of record developed in performing this acceptance sampling.

The same type of acceptance sampling is used to prove the acceptance of materials fabricated by King-Seeley. Samplings, screw machine parts, machine shop articles, die castings, and painted articles must all pass the same rigid tests before being passed on to the assembly line.

Intermediate check points in the assembly line have been established. Subassemblies are submitted to acceptance sampling inspection at these points before being permitted further assembly.

We do not want to leave the impression that acceptance sampling provides all the answers to the quality problems. Such is not the case. Rejected lots are constantly being encountered. This means possible rework, scrap, or use by waiver. Purchased material provides many such problems. Our inventories may be low, and the material not in compliance with the established quality levels. To return the material to the vendor could mean stoppage of production resulting in laying off employees and shutting customer operations down. When this situation is encountered quality control examines and weighs the cause for rejection. Possible waivers are considered as well as corrective cost. From such review, quality control is able to give the final decision regarding disposition of the material.

Quality control acceptance sampling procedures should not be construed to be the same as percentage inspection. The former is based on known consumer and producer risks while the latter allows one to gamble without any regard as to the risks being taken. We have learned that good quality insurance costs no more than poor quality insurance.

In our own manufacturing we use such quality control procedures as average and range charts, lot plot charts, and fraction defective charts, Figure 3. We use these charts when inherent variation in processing and abnormal fluctuations in quality proves that control without them is impossible. We do not believe in wallpapering our plant with control charts. Each chart used must be warranted. All

*(Continued on page 216)*

SOLD THRU LEADING SUPPLY HOUSES

**GROBET CHATTERLESS COUNTERSINKS**

Six staggered cutting edges give shearing cut that eliminates all chatter.

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.004" to .156"

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● Fingertip Variable Speed ● Fast Approach Air Feed ● Hydraulic Feed Adjustment ● Electric or Manual Control ● Deep Hole Drill Cleaning ● 1000-10,000 or 2500-15,000 RPM.

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A COMPREHENSIVE SET OF MEASURING TOOLS AND INSTRUMENTS providing means for indisputable control of all precision work.

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**GEORGE SCHERR CO., Inc.**

COMPLETE LINE OF PRECISION INSTRUMENTS

200-T LAFAYETTE ST. • NEW YORK 12, N.Y.

SEE ADVERTISERS INDEX, PAGE 183, FOR KEY NUMBERS

. . . Photography, from page 210

Exposure time on the cameras is generally computed at one-fifth times the reciprocal of the picture taking rate, and, therefore, one does not ordinarily think in terms of feet per minute, or feet per second, when taking high speed pictures, but the angular velocity of the subject. In other words, if one were photographing a revolver being fired, within a comparatively small field, the camera would record only two or three pictures of the bullet in flight when used in this position, because of the high angular velocity. If the camera is placed fifty times as far away, the angular velocity is reduced to one-fiftieth, and, therefore, one would obtain one hundred or one hundred fifty pictures of the subject for study. The same conditions apply to the closeup photography of machine tools. The third example in Figure 1 shows film traveling over a sprocket at 200 feet per second. It will be noticed that there is a little blur, but, nevertheless, the malfunctioning is easily observed, i.e., the film is climbing the sprocket. This was due to short pitch film, or film which had been perforated at sub-standard increments.

Auxiliary equipment has been developed to make the cameras easily used, along with appropriate light sources. A pair of these may give 100,000 foot candles which is sufficient to take black and white pictures at 8,000 pictures per second at F/5.6, while four of these lights give adequate exposure for color film at 5,000 pictures per second at F/3.5. Meters for measuring the light sources have been developed as well as other small pieces of equipment, such as very firm clamps for holding the lights, series parallel switches, and lenses ranging in focal length from one inch to fifteen inches. Furthermore, if users so desire, the cameras will be modified to suit their particular requirements. If a camera is going to be mounted, for example, on a shaper, for a reasonably permanent series of studies, and if some of this work occurs under high "G" conditions the feet would be left on the motor so that it could be anchored adequately to the camera base.

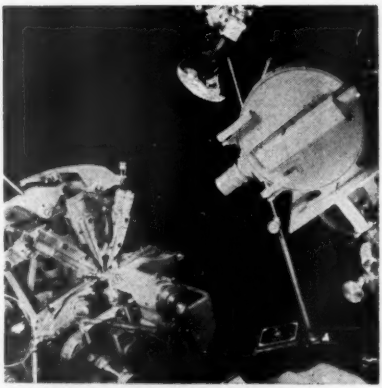


Fig. 5. The multitudinous-occurring actions of a Swiss automatic screw machine can be "stopped" by the camera, giving a series of still pictures of the succesive operations.

More recently, Dr. Edgerton has developed a small compact light source which can be fired by magnetic means from the Kodak and Fastax cameras at rates up to 7,000 per second with a flash duration of one and a half micro seconds. A high speed flash of this sort is primarily a laboratory installation, but one is able to increase the time revolution so that if one is studying high velocity subjects a sharper picture is obtained.

If one were studying machine shop operations, the Strob. light would be used for maximum clarity because the time reduction would be approximately thirty times using sixteen millimeter camera.

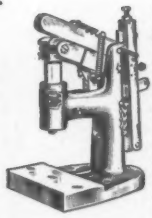
High speed photography is in its infancy, and those who are looking forward can see that every manufacturing organization that is doing a half million dollars worth of business a year, and is making things under conditions which are too fast for the eye to see, will profit greatly through applications of high speed photography. The amount of design time and observation time will be reduced tremendously through the analysis of the pictures which can be made.

A manufacturing organization, with judicious use of a camera, by the end of the second year should be able to save ten precent on costs of manufacture, either by stepped up production or by reduced rejects.

HIGH-SPEED

## COLD RIVETERS

Thousands of now happy users originally started with us by submitting sample assemblies of their riveting work. Without charge we studied their particular problem, and returned the assembly properly riveted with complete analysis, recommendations and quotations.
It's a FREE service, that may save you time, materials and spoilage—and speedup production. Why not write us?



## STAKING MACHINE

Is YOUR problem DIFFERENT? We have met and solved thousands of such problems—from cameras and meters to toys and electrical items.
Anything for staking or riveting fixed or movable joints—anything in eyeletting, grommeting, burring, pointing with platinum, tungsten, silver—whatever your problem, we can help you. No obligation. Write us.

HIGH SPEED Hammer Co., Inc.
306 Norton St.
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## RUNS COOL AT 38,000 RPM

Roto-Master Hi-Speed grinder makes carbide roughing and finishing available to every shop. Designed for operations requiring precise "finger-tip" control, in conjunction with carbide burrs and mounted wheels from 1/16" to ¼" dia.

MAKES CARBIDE ROUGHING AND FINISHING AVAILABLE TO EVERY SHOP

Roto-Master's SUPER COOLING system enables operating speed of 38,000 RPM. Operation requires practically no pressure . . . consequently grinder can be used continuously for hours without heating.
Operates on 110-120 Volt AC or DC, Any Cycle.

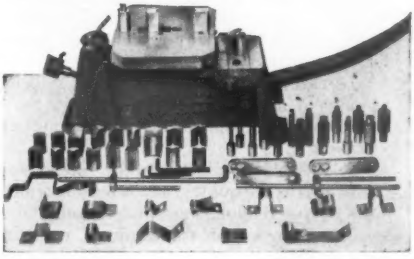
Try Roto-Master in your shop. If not completely satisfied return within 15 days at no charge. If not rated send check or M. O. for $32.50. Manufacturers' Agents Wanted.

$32.50

MASTER APPLIANCE MFG. CO., 4th at Ontario, Racine, Wisconsin

## THE Multiform BENDER

CUTS, BENDS, PUNCHES - WITHOUT SPECIAL TOOLING



Available in hand or air operated models, the MULTIFORM is shipped complete with full assortment of dies and mandrels to punch, bend and cut round or flat brass, bronze, aluminum, steel, etc., up to 3/16" x 1½" as illustrated, other models up to ¼" x 4". See our display booth H-154 at National Metal Show, Detroit, October 15th to 19th.

Write for descriptive literature.

## J. A. RICHARDS CO.

NORTH PITCHER ST. KALAMAZOO, MICHIGAN

SEE ADVERTISERS INDEX, PAGE 183, FOR KEY NUMBERS

. . . Profitable Quality, from page 212

**Calibrating electric gage dash unit. Units are inspected in lots of 500 to 800 by means of acceptance sampling tables with an acceptable quality level of 2.5 per cent.**

chart applications are reviewed each month by the quality control department and continued use must be substantiated.

Control charts are indicators of potential quality troubles which if allowed to develop will cause scrap and excess inspection. By means of the control chart advance notice of the pending trouble is given and action can be taken before scrap is produced.

Quality Control reviews specifications on all new products before they are released by engineering. This is done to insure that all necessary specifications are present, ambiguous specifications are corrected, and unnecessary or too tight a specification becomes corrected. Our experience shows that considerable tool cost can be saved by this activity. There have been occasions when a supposedly necessary die did not have to be built once the specifications were brought in line with what was actually needed to fulfill design intent.

Our quality control department "quality audits" our finished goods stores periodically. In this way inspection is continually alert to inspection errors and we get a preview of the quality from the customers' standpoint.

Our company has pioneered in quality level certification. By certification we mean written declaration by responsible authority that the specified quality level has not exceeded as exhibited by required data and test procedures. Such certification is furnished to the customer. This is our proof of quality and enables the customer to waive his costly receiving inspection.

Quality level certification is receiving intense promotion by industry. The reason is one of economics. Let us point out that a program of quality level certification is not possible unless a sound quality control program is enforced in your company. It is our belief that the quality level certification programs now being promoted by large companies will force many small and medium size supplier firms into quality control engineering.

A good sound productive quality control program can not be developed over night. The old adage "you must creep before you walk" is well worth remembering. We have seen several quality control programs die because the sponsors expected results to be obtained over night. You can not successfully operate a quality control program without engineering background. Let us give warning that if you are considering sending a shop man off to school for a few days with the hope that when he returns he will be able to introduce quality control in your company you may be living with false hopes. Qualitv control is a good management tool only when the quality control staff is capable of using the quality control science properly. Therefore, we feel that engineering background is a basic requirement.

In summary let us list the basic elements of a quality control program:

1. Objective specifications, adequately graded.
2. Efficiently engineered inspection procedures adequately recorded for transfer to the vendor, shop and customer.
3. Efficient and standardized measuring methods.
4. Practical quality levels satisfactory to the vendor, shop and customer.
5. Statistical quality control charts and sampling plans properly selected for use by the vendor, shop and customer.
6. Quality Audits.

*For Precision Work...*

**Baldor's**

## Carbide Tool Grinder

**has balanced armature and wheels, runs smoothly on LARGE ball bearings. Grinds wet or dry. ½ hp 3400 RPM reversible motor; 6" silicon carbide wheels. Complete price, $142.60.**

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**BALDOR ELECTRIC CO.**
**— Over 30 Years —**
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**2¼x HEADBAND MAGNIFIER**

Use of both eyes reveals true depth of details. Magnification of 2¼x. Free working distance, 8" to 10", permitting unhindered use of hands. By just lifting your head, your eyes are free for any other activity. Eyeglasses may be worn while using. Highest optical quality. **Write for leaflet.**

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**YOU should use Chicago "Safety Plus" Screws in Standard Listed Sizes.**

- **SOCKET SCREW PRODUCTS**
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- **NUTS • TAPER PINS • STUDS**

Chicago "Safety Plus" products are designed to give you a tighter, lower cost fastening for any heavy duty purpose. To speed delivery time, call the INDUSTRIAL SUPPLY DISTRIBUTOR nearest you today. Ask for Chicago and get "Safety Plus."

**CHICAGO SCREW COMPANY**
2215 Washington Blvd. • Bellwood, Ill.

SEE ADVERTISERS INDEX, PAGE 183, FOR KEY NUMBERS

## Stainless Steel Inserts Protect Aluminum Threads

To strengthen and protect the threads in tapped holes in aluminum housings and eliminate vibration wear, stainless steel helical-wound wire thread-inserts are installed in tapped holes of Ingersoll-Rand's "Impactool," a hand tool widely used for nut running, drilling, stud driving and masonry drilling.

Steel bolts are used to join the housing sections. If these bolts were screwed directly into the tapped aluminum holes, seizing and galling might occur during assembly, the aluminum threads would be subject to damage by tool vibration during operation, and the soft threads in the housing would wear when the tool is disassembled periodically for maintenance and repair. Installation of the stainless steel "liners" provides strong permanent threads which eliminate seizing, galling and wear.

The illustration shows the mass-production setup, using a high speed inserting tool, which has been devised to install the inserts. The inserting tool (rather than the workpiece) is clamped in a vise and the operator feeds inserts into the tool with one hand, holds the workpiece against the tool with the other, and operates the tool by foot pedal.

The inserts are precision-wound coils of 18-8 stainless steel having diamond-shaped cross-sections. When installed, the inside coil diameter, thread form, and pitch conform to the American National Series of thread contours.

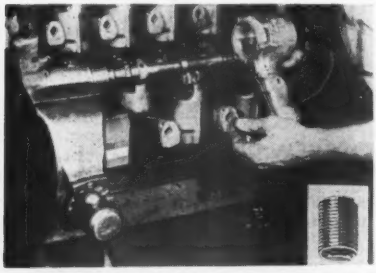

Photo courtesy Heli-Coil Corp.

## Jet Blade Grinder

In a standard machine for grinding the airfoil form on jet aircraft compressor blades, the machining cycle is completely automatic except for loading the work, pressing the start button and unloading the work at the end of the cycle. Accuracy of airfoil form is assured by the use of master cams made directly from the engineer's glass layouts.

During its cycle this precision profile grinder grinds the complete airfoil form including leading and trailing edges. As the work rotates, it moves lengthwise across the grinding wheel at an adjustable rate of feed. Because the area of contact between the work and grinding wheel is very small at the leading and trailing edges and quite large at the broad sides of the blades, the work speed changes as the blade rotates. A two-speed work drive motor slows down while the grinding wheel traverses the broad sides of the blades, then speeds up while the narrow edges are being ground. Thus there are two periods during which the fast speed is used and two periods of slow speed during each revolution.

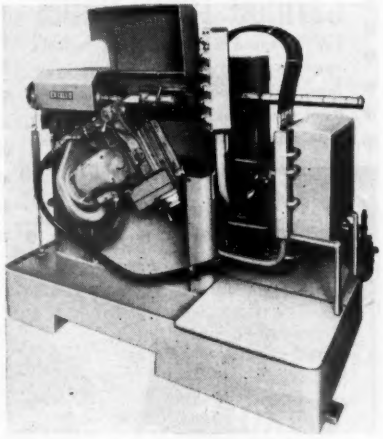

Photo courtesy The Ex-Cell-O Corp.

The grinding wheel is dressed with a hand operated, swivel type diamond dresser. The amount of stock dressed off the wheel is compensated for by the wheel moving toward the work an equal amount. The wheel can be advanced or retracted without changing its position in relation to the dresser.

# STOP DUSTS

INSTANTLY *with*

DUSTKOP

Available from stock of 22 standard models

*300 cfm to 10,000 cfm*

*Ask for Catalog 605-2. Describe dust problem for recommendation by return mail—No Obligation.*

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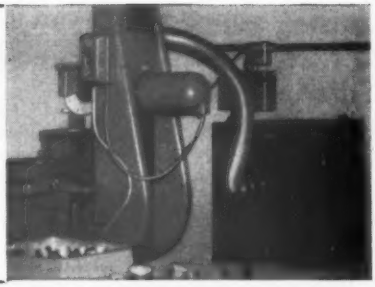
213 Main St. Ann Arbor, Michigan



SAVE ON PRODUCTION TOOLING COSTS with

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The exclusive, quick-acting clamping mechanism of SPEED VISE accommodates a wide variety of parts.

A HUNDRED JIGS IN ONE

Drill jigs are simpler, smaller and cheaper when made for use in a SPEED VISE.

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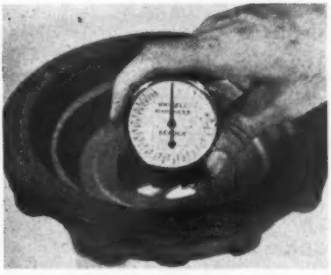
# BETTER TESTING EQUIPMENT *Will* IMPROVE YOUR PRODUCTS



The Dietert Brinell Hardness Reader can be used successfully by any one in your plant who can read a dial. No judgment is necessary, no charts or tables to consult and no figuring to do. It makes hardness testing foolproof. The Brinell Hardness Reader replaces the measuring microscope. It measures the depth of the Brinell impression rather than the diameter. The dial is graduated in Brinell Hardness Numbers.

*We will rush detailed specifications to you on these units if you will write to Dept. 16.*

Harry W. DIETERT Company

9332 Roselawn Ave. Detroit 4, Michigan

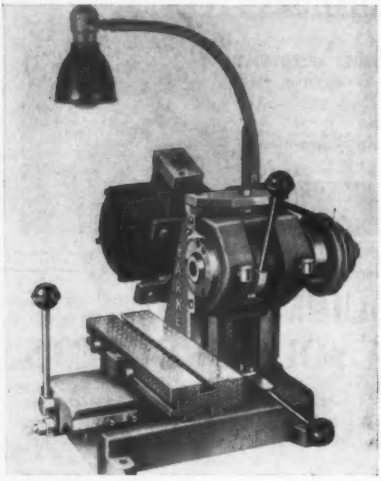
CONTROL EQUIPMENT - SAND - MOLD - MOISTURE - CARBON - SULFUR


SEE ADVERTISERS INDEX, PAGE 183, FOR KEY NUMBERS

## Milling Small Parts to Close Tolerances

The new Barker Bench-Type Miller has been designed and developed for the rapid production milling of small parts that must be held to very close tolerances.

It embodies the advantages of longitudinal table travel, transverse saddle travel and vertical head travel by hand lever operation on the production model (illustrated), or by accurately calibrated micrometer feed screws on the toolroom



model. Any one or more of the three travels can be furnished with micrometer feed screw in place of the hand lever.

The Barker Miller is capable of high production when fitted with proper production fixtures, and high spindle speeds make it excellent for use with carbide cutters.

This versatile machine can be operated with precision results by inexperienced help—a big factor with today's prevailing labor conditions.

A detailed bulletin is offered by THE BARKER ENGINEERING CO., 500 Green Rd., Cleveland 21, Ohio.
**Circle Inform-A-Gram No. D7.**

## 8½ Pound Hoist Lifts up to 1½ Tons

The "Lug-All" Portable Hoist, now offered by Ray J. Young Supply Co., weights only 8½ pounds, yet has a 1½ - ton capacity. Operation is either forward or backward, with control, and free release, when hoist has no load.

The "Lug-All" is excellent for all horizontal pulling or bending requirements. A "safety" handle bends before the hoist is dangerously overloaded.

Literature is obtainable from RAY J. YOUNG SUPPLY CO., 1311 E. 125th St., Cleveland 12, Ohio.
**Circle Inform-A-Gram No. D5.**

★ ★ ★

## Tough HSS Drill Rod in New 36" Lengths

Hardened and ground high speed steel drill rod in standard 36" lengths is now offered by Ace Drill Corp. These blanks have the equivalent toughness of conventional tool steel materials yet measure 6 points higher on the Rockwell "C" scale.

To achieve a combination of toughness, hardness and strength, ten-foot lengths of solid round bar stock are fed through a long, continuous heat treating furnace. The perfectly regulated movement and constant temperature combine to produce a hardness as uniform as the steel itself.

Blanks are cut out from this treated stock, and centerless ground. They are available as hardened, tempered and centerless ground in diameters from $\frac{3}{32}$" to 1", with a diameter tolerance of ± .001", or as hardened and tempered only in sizes from .118" to .515".

For details, write ACE DRILL CORP., 2600 E. Maumee, Adrian, Mich.
**Circle Inform-A-Gram No. D6.**

QUALITY CONTROL Calls For PRECISION FINISHES on CARBIDE TOOLS, DIES, ETC.

"MICRO MESH"
PURE DIAMOND LAPPING COMPOUND
WILL SOLVE YOUR
LAPPING PROBLEMS
and give you
MIRROR FINISHES
. . . in minutes instead of hours
*write for details*

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TOOL STEELS FOR
All Tools for All Purposes

CARBON GRADE:
Special, Extra, Extra Header Die, Waterdie Extra, Vanadium Extra, Standard.

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HEAVY DUTY
"MITI-MITE" NO. 150
*The new, amazing magnetic base holder for mounting Test Indicators to flat or curved surfaces INSTANTLY!*
NO MORE CUMBERSOME HAPHAZARD CLAMPING

Complete accessories included for taking all indicators up to 3" dia

Magnetic pull, approx. 100 lbs. Size of base, 1⅝" x 4".

Ball and socket swivel construction permits precision adjustment.

Fingertip control for operating magnetic release.

Shows MITI-MITE being used as surface gage.

| OTHER "MITI-MITE" UNITS | | |
|---|---|---|
| No. 100 | Magnetic base Holder for smaller test indicators. | $7.50 |
| No. 120 | Combination Test Indicator magnetic base holder and double lens 4X Magnifier. | 12.00 |
| No. 200 | Magnetic Base Handi-Lite complete with 25 and 40 watt bulbs. | 8.50 |
| No. 300 | Combination of No. 100 and No. 200. | 15.50 |

SEND FOR BULLETINS No. 602 and 603

ENCO *Manufacturing Company*, DEPT. 7101
4524 W. Fullerton Ave., Chicago 39, Ill.

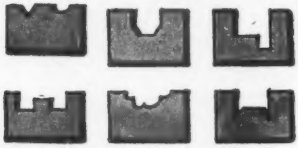
Order from your mill supply dealer or send order with name of your mill supply dealer

SEE ADVERTISERS INDEX, PAGE 183, FOR KEY NUMBERS

# NEWFIELD

## UNIVERSAL FLY CUTTER

Above: FACE MILLING



**ABOVE—a few of the many cuts that can be made with the Newfield Universal Fly Cutter in ONE operation on a horizontal or vertical mill or drill press. Individual adjustable bit holders permit slots of any shape to be cut 3/16" to 2" wide.**

### STANDARD BITS MAKE 4 TO 6 DIFFERENT CUTS IN 1 OPERATION

***For*** **many types of milling, light metals and plastics as well as steel, there is no longer need for special cutters. A single Newfield Universal Fly Cutter, utilizing any type of standard high speed steel or carbide bits, makes multiple cuts in one operation. In contrast with expensive specially ground cutters, the standard bits used in the Newfield are easily and quickly ground in your own shop, readily replaced or reground for other work, at small cost. There is practically no down-time if a bit is broken.**

**The Newfield fits all standard arbors, turns to any required speed for fly cutting, slotting, surface and straddle milling, gear cutting, disc and gasket cutting. Standard sizes are 4", 6", 8", 10".**

***Write today for details of this versatile, production-upping, money-saving tool.***

**NEWFIELD MACHINED PARTS CO.**
**210 W. Seventh St. . .Los Angeles 14, Calif.**

## Indicating Snap Gage

In addition to the long wear life provided by the tungsten carbide gage points on the Foster Indicating Gage, this instrument has "built-in" compensation for wear so that any indicator wear will not affect gaging accuracy. The generous size of the measuring anvils plus the adjustable "back-stop" insures that the work will always be measured across a true diameter. The fixed-adjustable lower anvil has generous bearing area in the frame so that when rigidly locked it remains truly parallel to the indicator anvil. The precision construction of the indicating anvil insures parallelism throughout its travel.

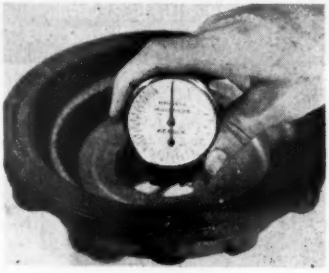
FOSTER ENGINEERING CORP., 4200 N. Woodward Ave., Royal Oak, Mich., will furnish details.

**Circle Inform-A-Gram No. D8.**

★ ★ ★

## Hardness "Reader"

The Dietert Brinell Hardness "Reader," which replaces the measuring microscope as a testing machine accessory, measures the depth of a Brinell impression in a matter of seconds without eyestrain and without consulting any tables and/or charts.



Literature on this pocket size instrument can be had from HARRY W. DIETERT CO., 9332 Roselawn Ave., Detroit 4, Mich.

**Circle Inform-A-Gram No. D9.**

**Are you Saving Pennies or Losing Dollars?**

True, we could make lower grade tools and sell them for a few pennies less, but your production costs would soon prove the fallacy of saving pennies on tool costs and losing dollars on production.

Real tool economy is the lowest final cost per unit rather than the lowest tool cost.

You may be sure it takes more time, better steel, better heat treatment, more experience and skill to produce Tri-Jay Masterform quality tools, but the production records of hundreds of big firms using them prove they are worth more because of their high productive life.

*Write for Bulletin #350.*

**TRI-JAY MASTERFORM TOOL CORP.**
6314 Northwest Highway, Chicago 31.

*Eliminate* MARKING DEP'T BOTTLENECK

*Writes Like a Pencil on Anything!*

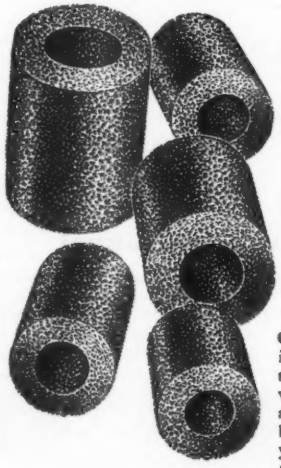
*Engrave with* **BURGESS - vibro-graver**

Now you can *permanently* mark steel, cast iron, glass, wood, lead and other hard surfaces as "O.K.," "Reject" . . . or with serial numbers, names for identification, departmental insignia, etc. Burgess electric Vibro-Graver with Tantalum Carbide point engraves as easily as writing with a pencil. (Diamond point also available.) Stops mix-ups! Avoids confusion! Helps prevent theft and inventory shrinkage! Ideal for Government contract work. Write, stating marking problem, for full information.

Only $8.95 Complete

**BURGESS VIBROCRAFTERS, INC.**
182 NORTH WABASH AVE., CHICAGO 1, ILL.

**CHICAGO**
# Internal Grinding
**WHEELS**



**MANUFACTURED TO ORDER**

*Rapid Delivery*

Advanced production methods assure you perfectly balanced Internal Wheels to meet rigid finishing requirements. Faster delivery . . . with overnight service for special jobs.

Chicago Internal Grinding Wheels produce better finishes with longer wheel life and cutting action. They're your best buy—"tailor made" to your specifications and speedily delivered.

**WRITE TODAY for full information and free sample wheel.**

**CHICAGO WHEEL & MFG. CO.**
Dept. TP, 1101 West Monroe Street
Chicago 7, Illinois

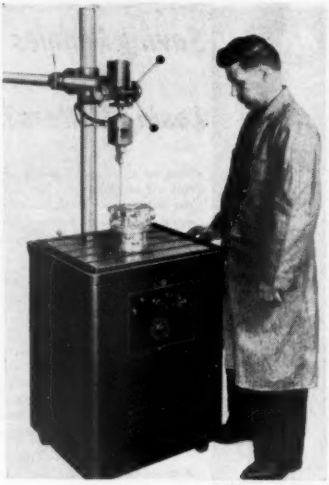

SEE ADVERTISERS INDEX, PAGE 183, FOR KEY NUMBERS

## Broken-Tool Removal Saves Valuable Parts

Metal Disintegrators can give a big "assist" to quality control. At one time it was thought that a valuable production part was ruined when a drill or reamer was broken off in it during manufacture. Now these production parts may be saved without any loss of quality.

The core of the broken tap, reamer or drill is disintegrated speedily and without tempering in any way the adjacent metal in the part. Common removal times that have been recorded include: ⅛" drill, 2" deep, in 1½ minutes; $\frac{37}{64}$" reamers, 1½" deep, in four minutes, and ¾" tap, 2½" inches deep, in 18 minutes.

Also, many dies are saved that otherwise would have been rendered useless because of errors originating in layout of machine operations, since accurate concentric holes may be disintegrated in heat-treated die sections without annealing.



Complete details are obtainable from ELECTRO ARC MFG. CO., 5930 Commonwealth Ave., Detroit 8, Mich. **Circle Inform-A-Gram No. D3.**

★ ★ ★ ★ ★

## P&W "Control of Quality" Library

To help you maintain better quality control in quantity production, Pratt & Whitney is offering a series of detailed and illustrated circulars giving the latest in gaging information. This "Control of Quality" Library consists of 23 booklets, any one (or several) of which can be obtained by writing to Pratt & Whitney, 15 Charter Oak Blvd., West Hartford 1, Conn., and by specifying the code number of the booklet desired.

Booklet numbers and titles are: 1. Air-O-Limit Comparators; 2. Electrolimit External Comparators; 3. ANPT Pipe Thread Gages; 4. Magnetic Gages; 5. Carbide Dualock Adjustable Thread Ring Gages; 6. Multiple Electric Contact Gages; 7. Electrolimit Internal Comparators; 8. Electrolimit Mill Gages; 9. Oil Country Gages; 10. Electro-Mechanical Lead Tester; 11. Carbide Precision Gage Blocks; 12. Electrolimit Snap Gage; 13. Tri-Roll Thread Comparator; 14. J-S Roll Thread Snap Gages; 15. Electrolimit Millionth Comparator; 16. Electrolimit Universal Internal Comparator; 17. Electrolimit Height Gage; 18. Thread Gages; 19. Standard Measuring Machine; 20. Supermicrometer; 21. Precision Gage Blocks; 22. Pipe Thread Gages; and 23. AGD Adjustable Limit Snap Gages.

★ ★ ★ ★ ★

## Statistical Quality Control Training Manual

Written by Rudolph Freedman and Joseph Movshin for use in short elementary courses in statistical quality control, "A Basic Training Manual on Statistical Quality Control" is now available at a single-copy price of $2.50 from the St. Louis Society for Quality Control, 6651 Kingsbury, St. Louis 5, Mo.

This manual may be used in plant training and short courses that are often given by technical societies, and also as a laboratory manual in conjunction with a standard text on quality control in a full course.

It consists of a brief text that is included to serve as a set of notes for the students. The heart of the manual is a series of work sheets covering frequency distribution, X & R charts, p charts, pn charts, c charts and sampling.

In quantities of 10 or more, the price is $2.00 per copy and an instructor's guide is available upon request at no extra charge with each order of 10 or more copies.

## OPTICAL FOLLOWER

spaces holes to jig borer accuracy. Excellent for batch quantities. Fits any vertical milling machine.

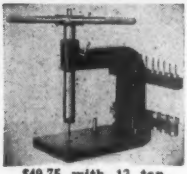
*Write Airmail for information.*

BOECKELER INSTRUMENT CO.
P. O. BOX 181 TUCSON 1, ARIZONA

## Lassy TAPPERS

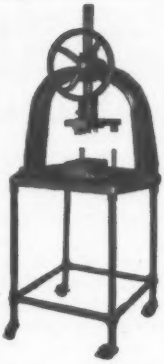
UNIVERSAL
**TAP AND DIE GUIDE FIXTURE**

Assures Good Threads
Maintains Correct Depth
3 Sizes
Free Folder



$49.75 with 12 tap adapters No. 5 to ⅝"

**LASSY TOOL CO., Plainville, Conn.**



## COMPLETE THE DIE-SET AT YOUR BENCH

**Lacey Die-Set Machine**

Here's a truly "one man" press. It operates with one hand. Handy for tool and press rooms, it permits the diemaker to complete a die-set right at his bench . . . saves toolroom and handling costs. Ask today for full details.

Sole Distributors
**MOORE SPECIAL TOOL CO., INC.**
726 Union Avenue Bridgeport 7, Conn.

## WHITNEY-JENSEN PRODUCTS
41 YEARS EXPERIENCE

### WHITNEY-JENSEN
**Nos. 28, 29, 58, 68**
**Deep Throat, Toggle Action**
### FOOT PRESSES

The deep throats (7", 10", 18", and 24") and powerful punching action of these foot presses permit the handling of a wide variety of work. All sizes, with 5 ton capacity, punch a 2" hole through 16 gauge mild steel.

Length of stroke—1"
Height of throat—6¾"

*Write for Literature*

**WHITNEY METAL TOOL COMPANY**
724 FORBES STREET • ROCKFORD, ILLINOIS

SEE ADVERTISERS INDEX, PAGE 183, FOR KEY NUMBERS

## Improved Optical Comparator

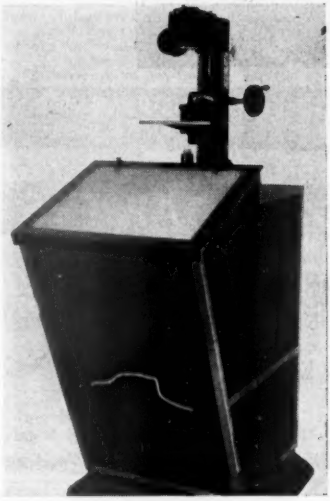
The new Portman "Century" Optical Comparator (Model C-100) incorporates several entirely different mechanical and optical features.

The "Super-Light" condenser lens unit, which is power cooled, provides exceptional screen definition. When used with color filters, intensity and shading of light may be varied.

Also offered by the "Century" are the advantages of a new stage design. The new staging assembly provides large working space and includes a so-called swing feature permitting the entire stage and workpiece to be moved completely to one side, facilitating the change-over of lens units without disturbing work setups.

The new Portman "Ciptar-Scope" optical system has been designed to complement the large mechanical capacity of this new comparator. The special "Ciptar" lens provides very long focal lengths, maximum light, large objective areas and sharp definition. Focal lengths average in excess of 3". In addition, the screen image is oriented with respect to the position and movement of the projected part. Magnifications of 10X, 20X, 25X, 31¼X, 50X, 62½X and 100X are obtainable as standard equipment.

Complete information on these and other features of the "Century" Optical Comparator is available from PORTMAN



INSTRUMENT CO., 6 Manhasset Ave., Port Washington, N. Y.
**Circle Inform-A-Gram No. D10.**

★ ★ ★ ★ ★

## A System of Visual Control

Industrial executives can now visualize, at a glance, the operating effectiveness of their organizations through the Visi-Trol control system.

This system, consisting of chart boards that are assembled from standardized parts to any size to suit the user's needs, avoids the necessity of recording superfluous data. If necessary, however, you can have all the facts—plant capacity, weekly and accumulated commitments, productive and non-productive labor, plant efficiency, etc.—on just a single board. Confidential information can be coded to let you look at the facts without revealing their identity.

Some of the Visi-Trol features include the following: maximum graphic lines of data per foot without sacrificing visibility; maximum visibility through large letters, figures, symbols, etc.; design versatility—data channels can be run vertically, horizontally, diagonally or any combination; fast posting—letters simply snap in and out, and telescopic strips save time in changing records; no cross-records required; and channels have double-rolled safety edge.

Typical uses are for plant efficiency, competitive standings, demurrage, machine loads, schedule and progress reports, etc.

Illustrated literature is obtainable from VISI-TROL CORP., 9345 Hubbell Ave., Detroit 28, Mich.
**Circle Inform-A-Gram No. D11.**

# 441 STANDARD SIZES OF MARSHALL STEEL PRECISION GROUND FLAT STOCK

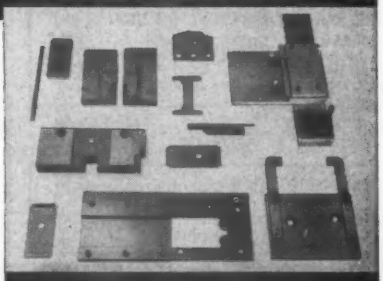
**The world's largest range of sizes of precision ground tool steel in three grades are available, ready for immediate shipment and the layout bench.**

**WATERcrat:** A fine grained electric furnace high carbon tool steel. It has been wet ground to remove all bad surfaces and to assure velvet finish of virgin metal.

**OILcrat:** An outstanding product of careful handling assures you of a fine grained electric furnace oil hardening ground flat stock ready for the layout bench.

**AIRcrat:** This air-hardening tool steel shows less size change and offers a greater safety in hardening than either of the other grades. **Dept. TD**

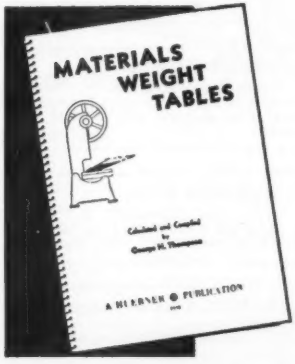
*Write for descriptive literature, catalog of sizes and prices.*



**MARSHALL STEEL CO.**
LA GRANGE, ILLINOIS

The Aristocrats of Ground Tool Steel

# Every PLANT needs . . . .




**"Faster than a Slide Rule" for calculating the total weight of sheet stock required for a given press run.**

**"Easy to use" — only one computation instead of the four usually necessary with a slide rule.**

**The book includes 32 pages of tables for sheet stock, 4 pages for bar stock, 3 pages for drill rod and conversion factors for 20 different metals, thus making the tables apply to almost any stock you might be working.**

**$2.50 per copy**

**TOOLING & PRODUCTION**
**1975 Lee Road, Cleveland 18, Ohio**


SEE ADVERTISERS INDEX, PAGE 183, FOR KEY NUMBERS

# CONTRACT TOOLING AND PRODUCTION

## Arizona & California

**ARIZONA TOOL & DIE COMPANY**
P.O. Box 181, Tucson, Arizona—Dial 3-8842. Jig boring and repetition hole spacing work using Boeckeler OPTICAL FOLLOWER. Specialists in radio chassis work.

## Illinois

**DRESEL-BETZ CO.**
Belleville, Ill.
Designers and Manufacturers of Tools, Dies, Jigs, Fixtures, Metal Stampings.

## Michigan

**DAVIS TOOL AND ENGINEERING CO.**
19250 Plymouth Road, Detroit, Michigan, VErmont 5-6000. Tools and Dies, Special Machinery. Sheet Metal Stampings and Assemblies.

## New York

**AMERICAN MEASURING INSTRUMENTS CORP.**
240 West 40th St., New York 18, N. Y. Jigs fixtures, gages, dies, precision parts.

**CONRAD & MOSER**
2-28 Borden Ave., Long Island City, N. Y. Machine Tools & Molds, Parts & Machines Aluminum Cast Parts, Aluminum Sheet Formed Housings.

**THE PIPE MACHINERY COMPANY**
261 Fifth Ave., N. Y. C., MU. 3-0934-5-6 Mfgs. Thread Gages-taps-dies, (large stocks, specials and standards)—established 1912.

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13404 St. Clair Ave., Cleveland, O., MUlberry 2600
DESIGNERS AND BUILDERS
Jigs and Fixtures Special Machines
*Production Engineering*
Complete Plant Routing and Tooling

**THE DENNING MANUFACTURING CO.**
2024 E. 70th St., Cleveland, O., EX. 4900 Designers and Builders of High Grade Dies.

**GENERAL DIE & TOOL CO.**
2067 W. 55th St., Cleveland, O., WOodbine 4736. Dies, Tools, Jigs, Fixtures, Light Stampings, Special Machinery Manufacturing.

**H & P DIE & STAMPING CO.**
13947 Triskett Rd. Cleveland 11, Ohio
PRECISION DIES, JIGS & FIXTURES
*Quality Stampings*
Bus & Trailer Parts

**THE INDUSTRIAL MACHINE CO.**
1436 East 47th St., Cleveland, O. Founded in 1908. Builders of Special Machinery. General Machine Work.

**KIFFER TOOL & DIE CO.**
5601 Tillman Avenue, Cleveland, Ohio, WOodbine 2440-2441. Manufacturers of Special Machinery, Tools, Dies, Jigs, Fixtures, Swiss Jig Boring.

**NOBLE & STANTON, INC.**
998 Broadway, Bedford, Ohio, Bedford 1234. Tool Makers—Short Run Production Work.

**THE PHOENIX MACHINE CO.**
2711 Church Ave., Cleveland, O., CHerry 1048 Contract Grinding, Boring and Planing. Lester-Phoenix Die Casting and Plastic Molding Machines.

**A. P. SCHRANER & CO.**
3338 Payne Ave., Cleveland, O., HEnderson 3644. External Cylindrical Lapping Machines, Special Machinery, Tools, Dies, Jigs, Fixtures.

**SKYLINE TOOL & GAGE CO.**
4125 Newark Ave., Cleveland, O., ATlantic 1-2019. Designers and Builders, Jigs, Fixtures, Dies, Special Machines and Parts. Short Run Production.

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**RATES—$2.00 SERVICE CHARGE**

**PLUS 20c PER WORD—PAYABLE IN ADVANCE**

TOOL & DIE MAKERS. Write regarding employment in dry, sunny Tucson—particularly if there is health problem. P. O. Box 181, Tucson, Arizona.

## CUTTERS and COLLETS *that Last*

It's in the steel and the mechanical perfection of manufacture.

PANTO

Write for data on wide range of styles, types and sizes.

**H. P. PREIS ENGRAVING MACHINE CO.**
**647 Route 29 • Hillside, N. J.**

## *Announcing* COLONIAL #3

**A More Wear-Resistant Drill-Jig-Bushing Steel**

*Fully Field-Tested*

All standard COLONIAL drill jig bushings are now made from Colonial #3—a new oil-hardening steel having many times the wear-resistance of former bushing steels. Also gives greater uniformity.

*To reduce your bushing costs, specify bushings made from "Colonial #3".*

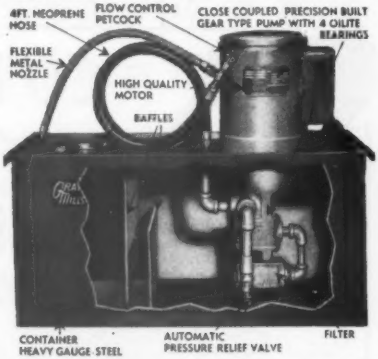
**COLONIAL BUSHINGS INC.**
P.O. BOX 37 HARPER STATION
DETROIT 13 MICHIGAN

## Get more production from your machines with GRAYMILLS Pumps and Coolant Systems

**A complete portable system**

**Convert to wet cutting in 5 to 20 minutes**

**Graymills Coolant systems and pumps increase cutting speeds, improve work quality . . . tool life. Most industrial distributors stock standard units.**



**Sturdy high pressure gear models . . . smooth high volume centrifugal types in 1/25 to 70 g.p.m., with tank capacities from 5 to 38 gals. Also immersion type centrifugal pump and motor units.**

***WRITE FOR NEW CATALOG TO***

**GRAYMILLS CORPORATION**
**2004 RIDGE AVE. EVANSTON, ILL.**

SEE ADVERTISERS INDEX, PAGE 183, FOR KEY NUMBERS

## FROM ROUGH TO FINISH GRIND IN ONE STEP

PAT. PEND.

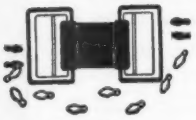
TYPE TD

10 TD 10" 14 TD 14"

TWIN WHEEL TOOL GRINDER
(Also single cup wheel)

**With The World's Most Modern Grinder For Carbide, Stellite, or High Speed Steel Tools . . . .**

Heavy Duty, Wet or Dry, 10"-14" Wheels



OLD WAY

Lost time between rough and finish grind.

Floor space wasted—Grinder must be away from wall.

*NEW WAY*

*One step from rough to finish grind.*

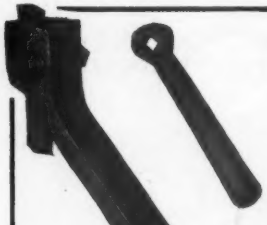
*Conserve floor space—place Grinder against the wall.*

Positively no spray or splash when grinding wet!

*WRITE TODAY FOR BULLETIN TW*

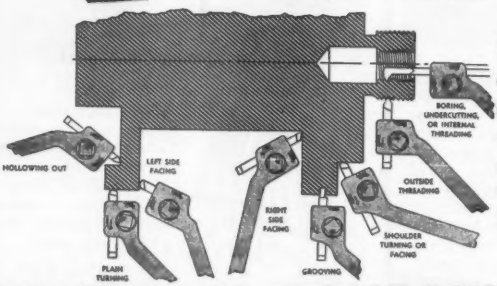
VISIT OUR BOOTH G-210, National Metal Exposition, Detroit, Mich., Oct. 15-19, 1951.

**THE STANDARD ELECTRICAL TOOL CO.**
MT. HOPE AND SIXTH STREET CINCINNATI 4, OHIO



# CUT TOOL COSTS 80%

## USE ONLY ONE TOOL HOLDER




**This Universal Tool Holder can be used for any lathe, shaper or planer set-up, does internal boring and threading, is ideal for carbide tools. Bit sizes: ¼", 5/16", 3/8", 7/16".**

**ACME TOOL COMPANY** 69 WEST BROADWAY NEW YORK 7, N. Y.

# NEW! DUMORE PRECISION DRILL GRINDER

## ...licks your 3 big problems in small-hole drilling

***CUTS DRILL COSTS*** You can now make substantial savings by sharpening drills (from No. 70 to ¼") with the new Dumore Drill Grinder. Dumore precision sharpening pays off in less drill breakage, longer drill life between grinds, and lower drill costs.

***INCREASES HOLE PRODUCTION***

Correct drill point and clearance angle are vital for fast material penetration. Both are instantly set on the Dumore Drill Grinder to give you even precision-ground lips. The result is correct hole tolerance, less reject and scrap losses, and higher production.

***SIMPLIFIES YOUR HELP PROBLEM***

Any operator can grind drills correctly. You are no longer dependent on outside sources or your own tool-grinding experts. If your layout calls for centralized drill grinding, anybody — man or *woman*, can easily handle sharpening for the entire plant.

*Check these features*

- ✓ **Instant Drill Point Angle Selection**
- ✓ **Speedy Clearance Angle Setting, 5°, 9°, 12°, etc.**
- ✓ **Feed-In Screw Precision Adjustment**
- ✓ **4-Power Drill Point Magnifier**
- ✓ **Special Web Thinning Wheel**
- ✓ **Broken Drill Reclaimer**

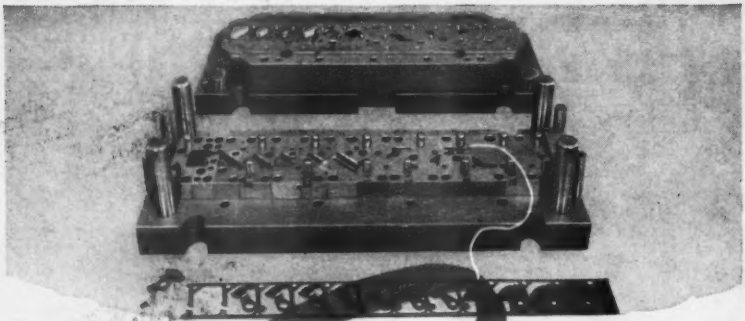
MAIL TODAY

**The DUMORE Company**
RACINE, WISCONSIN
Export Address: 13 E. 40th St., New York 16, N.Y., U.S.A.

☐ *Please send me New Precision Drill Grinder Bulletin*
☐ *I'd like to see a demonstration*

Name _____
Title _____
Company _____
City _____ Zone _____ State _____

**100% MONEY-BACK GUARANTEE!**



# why will this die cost less to operate

**There are two basic reasons.** Continuing analysis of die life at Lamina determined that the grinding procedure followed in building and servicing a die definitely limits the number of pieces a die will produce. As a result of extensive research and experimenting, we have developed a grinding procedure in our shop that increases die life considerably. This procedure is followed in building all Lamina dies and has been instituted in the die service departments of many customers' shops with outstanding savings.*

Lamina patented Guide Pin Bushings, used on all Lamina-built dies, combine the free-running action of bronze with the long-wearing service of hardened steel. Thus down-time due to guide pin wear or seizure has been materially decreased and bushing replacements have been practically eliminated.

This colorful bulletin illustrates Lamina's unusual facilities and fully describes our range of products and services. Included is full description of the Lamina Guide-Pin Bushing. Send for your copy, there is no obligation.

These are but two of the built-in factors which definitely cut operating costs for users of Lamina-built dies . . . they are the reasons that users, interested in not just first cost but in overall cost, come back again and again to Lamina for their die requirements. **Lamina Dies & Tools, Inc., 14925 W. Eleven Mile Road, Berkley, Mich.**

*This procedure and its effect is discussed in detail in a booklet entitled "Increased Die Life", copyrighted by Lamina Dies & Tools, Inc.

Lamina DIES AND TOOLS

LAMINA